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THE KANSAS CITY REVIEW OF SCIENCE AND INDUSTRY.

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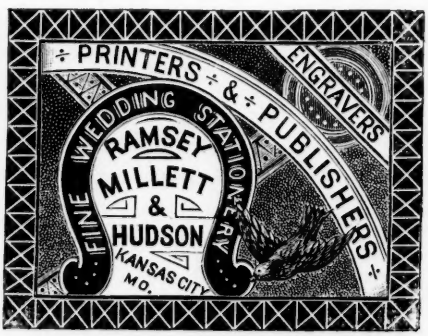

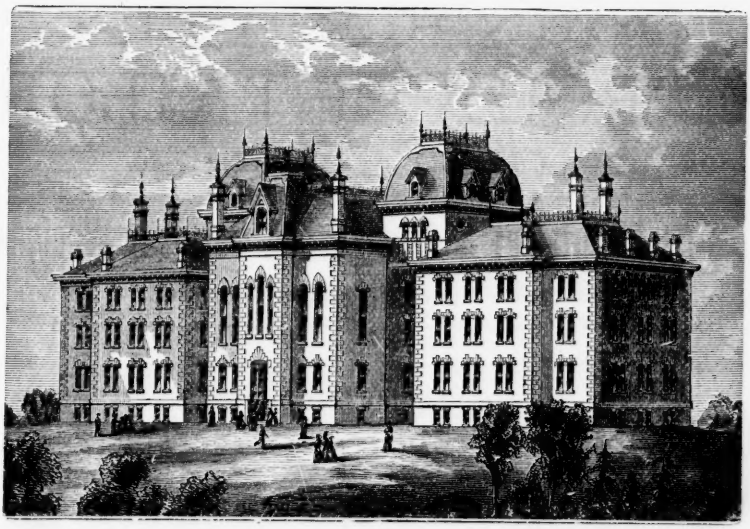

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REVIEW OF SCIENCE AND INDUSTRY,

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VOL. VII. JUNE, 1883. NO. 2.

SOCIOLOGY.

CRIMES AND CRIMINALS: HOW SHALL WE TREAT THEM.

GEORGE HALLEY, M. D.

The great social problem that is now agitating every form of governmental organization, is How shall crime be prevented? It is a wail of agonized anguish that began with the history of the race, and increasing in intensity and pathos now ascends to heaven from every kindred, and tribe, and nation, and tongue, as well from the high-bred and cultured Anglo-Saxon, as from the most degraded tribe found on the "dark continent." Almost the opening chapter of the history of the race, is the recital of the most terrible of crimes,—murder!

It is the spectre that stalks us at the entrance of this field of explorations. It is a constant companion at every step of our progress, and at the present time is the great unsolved problem in sociology, as well as the rock on which all organized government is liable at any moment to split. The cry of the world now is "A government for the people and by the people!" But a large mass of those people are criminals who know, feel, fear, and care for no restraint but force—cruel, vindictive, physical force. How shall they then who are steeped to the lips in crime, knowing nothing of morality, feeling no moral restraint or obligation, and, of course, ignorant of all law but that of force, control themselves or frame laws to control others (that criminal element) in that body politic? It is like asking the water of the river to carry back again to the top of the mountain tops, the silt that it has just carried down into the valley, or for the dark and

silent grave to give back the beloved form that it has just folded to its bosom. The wand of a fell spectral magician is upon them. They see, but do not perceive. They hear, but do not understand. They are sick, and miserable, and blind, and naked, and yet insist that they are in health, enjoying luxury and pleasure.

What is wrong, and wherein does the diseased process lie? In what does the morbid condition of the moral nature consist? Man is at least a dual being, physical and moral.

Of the physical we know much, principally because of its very nature we are capable to taking cognizance of it by our physical senses. Breaking of physical law is at once followed by tangible results—either producing physical suffering or even somatic death. We see it acted upon by the very same laws that are acting on all organized matter. It begins to live—so does a tree or a blade of grass. It reaches an equilibrium of existence and reproduces its kind, and so do all forms of animate nature. It declines just as a plant does, and dying, like the plant, returns to its original dust.

We know something of the laws that govern it. We study them in every avenue of scientific investigation. But the laws that govern our moral being are not so known or understood. They have never been studied or formulated. No laws are laid down for the maintenance of its health or general well-being, in any text-book, or system of science, and we are yet groping in the dark. Knowing we have a moral nature we are still in the dark as to the laws of its existence.

But is it really true that we know no laws that govern it? Are they different entirely from those that govern our physical nature, or are they not all under the same great general laws, each nature having some special and differentiating law, where the natures are entirely differentiated?

In our physical organism we know of and describe a great many processes that occasionally go on in the economy, and which, being allowed to continue, finally culminate in death. We call them disease. It may be erysipelas in the hand for instance. We say the *man* is sick—not the hand—for the organism is a unit, and all suffers, though the manifestation is only in one hand. Or the lung is inflamed, and the whole economy suffers, not because the whole economy is diseased, but because the organism is a unit, and one portion or part failing puts all other parts out of harmony—breaks the fine adjustment of the chord in the grand anthem of existence. We have said the whole economy is sick though only one organ is diseased. Why is this? The food that feeds the one hand feeds also the other. The food that is supplied to the lung, if not the same, is drawn from the same great fountain that also supplies the brain. But that fountain of supply is also the receptacle for waste from the whole economy, and when a tissue or organ is diseased, its worn-out (and diseased) particles going back by nature's systematic carriers, pour the waste in the common reservoir and so pollutes the whole mass. Almost every diseased process illustrates the truth of this.

Now a medicine is an agent that when taken into this circulating current has the power of changing the nutritive qualities of the fountain of food. It may be,

by destroying what is poisonous, or it may—and generally is—something that enables the economy of nature to remodel or re-elaborate the food, in a way that will not only enable it to be not poisonous, but it shall contribute to the tissues what was intended. These latter remedies are called alteratives, eliminators, nutrients, etc.

Nutrition is the taking up from the nutritive current, material that is fully prepared to, and does take on, and give forth vital manifestations. It is always made up of substances that are chemically or physiologically like the tissues of organs it is destined to build up and take the place of. In this way the tissues of the body are maintained in a state of health, from month to month, and from year to year; worn out parts being replaced by tissue made up of similar compounds to that that has been worn out. But certain kinds of food when given for a long time, will produce marked changes in the bulk of, and relative proportion of the tissues. This will not be so marked in an individual, as in large masses of people, as for instance the beef-eating Englishman and the rice-eating Chinese; or on the wine-drinking Frenchman, and the beer-drinking German. It does not alter the argument to say that the climatic or atmospheric conditions have compelled certain people to live as they do. That there are most important differences in races that at a comparatively recent period were identical, is beyond a doubt, and that food and feeding have contributed largely to those conditions is also undoubtedly true. Shakespeare makes Cassius say.

"Upon what meat doth this our Cæsar feed,
That he is grown so great."

Feeding then, perhaps more than any other physical factor changes the physical form; promoting not only growth, but development.

But a new factor now comes into the field to dispute for pre-eminence in modification of the physical nature. It is not the albumen or hydrocarbons, modified by any material of a medicinal nature, alterative, eliminative or nutrient. It comes not through the blood current nor by the process of digestion and assimilation. It is not climatic or atmospheric. It is not weighed by grains or pounds. It is mental impressions through the physical and on the moral nature.

We often—nay, are constantly—in the habit of under-valuing these, though they have been known, and acted on by men of the world for more than four thousand years. Jacob, in order to defraud his father-in-law of his share of the increase of the flock, had recourse to mental impressions on his herds, and as the narrative tells us, with remarkable success, the increase being "ring, streaked and speckled." But to the human race again.

I find in that same history just quoted from, another most marvelous story, and which to day attests the truth of what I am trying to prove. It is the story of Ishmael.

Let us for a moment read the history given of him, and in order to fully comprehend it we must begin with his mother. In the first place then, she was a slave, she was an African, and she was a *woman*. The wrongs of slavery are

of too recent date to require dilating on here. But the slavery of America was as nothing compared with that of barbaric life. There, power without responsibility, was law. The will of the master was absolute, and could not be questioned. The power of life and death even was in his hand, and none might call him to account for it. But in this case it is not only an African slave, but that slave is a *woman*. In a Christian land and with the social habits that Christianity has founded, it is hard for us to conceive of a state of society where a woman has absolutely no rights, and yet that is the status of woman to-day in pagan lands, and was most certainly the status of woman in those times, the history of which we are quoting. But in reading further on we find she is given over to the lust of her master without even being consulted in the matter, and when her mistress finds she is about to become a mother she is angry with her, and even for a slave is said to have *dealt hard* with her. How much that means no tongue can now tell. She was of a despised race. She was the slave of a furious woman. She ran away, but had to come back again, and in that plight she was when she brought forth a son. What a beginning for the father of a nation!

But again. He grows up in that camp the bastard son of a negress slave, and was the butt of scorn and ridicule in that nomadic camp. But he has a fine constitution derived from his parents, and soon shows that he can hold his own with the best of them. He is spoken of as a probable heir to the whole estates of his father. But he despises him and when a real heir is born, he mocks at the ceremony at his birth. He is driven from the camp, with the tigress that has nutured him, and becomes a wild man. Just what he is most fitted for, both by conception, birth, and early training. "With his hand against every man, and every man's hand against him." Is such a father not a fit progenitor of the Arab of to-day, leading essentially the same life, on the same soil, and in many ways under similar conditions to what their father led? They are a standing verification of the truth of the story, as detailed in the Book of Genesis.

What has been done to the moral nature of this race? How has it been twisted, and distorted, turned as it were into another channel? A mighty force has been projected into the track of this race, and forced it into a new and continually diverging channel, a force that has been potent enough, to entirely divert the destiny of the whole race into the new channel that it was projected into, for more than forty centuries.

But these are not the only examples that I could adduce; I might refer you to the gouty subject. His parents for generations may have been healthy and frugal. They lived temperately and enjoyed the reward of it, in good health. They moreover transmitted to him a good hereditary tendency along with a handsome fortune. In this they did well. But in one thing they failed. They left his moral training to the companions he might pick up, and it results in his becoming a high and fast liver, the result of which is that his excretory organs become impaired; there are retained in his blood-current large quantities of nitrogenous compounds which from defective oxidation are acid in reaction and uniting with the alkali of the blood sodium form compounds that are named gouty.

But this state of health does not terminate with himself, if he have progeny, any more than does the color of his hair or eyes. The evil forces that thwarted and misdirected his nature, are carried on into even his children's children, though they do not lead the same manner of life.

To those who object to the harsh and vindictive, or even as some say, unjust paragraph in the second commandment, I have to say that the law of our organic nature shows the truth of it, and when studied closely, the justness and mercy of the law, more forcibly than any mere verbal statement could have made it.

We see then how profoundly our physical and mental natures are bound up by our moral nature, or, I may say, with the morality that has existed from generation to generation. How the whole moral phase or morality of a nation may have been the result of fortuitous circumstances. How a mighty force projected into a national life may for generations change the whole moral nature of that people.

But what is true of nations is true of individuals, and conversely. National life is but the aggregation of individual lives.

A case that is often quoted from the criminal records of New York is of a woman who was abandoned to all good influences and by adverse circumstances and was at first, *driven* to crime and speedily became its slave, in less than one hundred years had a progeny numbering in the neighborhood of six hundred, of whom nearly four hundred were criminals.

What was it that in her case brought about such dire results. The history of her race reveals no special notoriety. The disturbing influences attacked her, and the results were most disastrous. That it could have been avoided there is but little doubt. The only thing done was to punish the criminals after they are made. Would it not have been much better to stop making criminals, than simply punish for the commission of crime?

But how do we treat criminals, and is it rational? Is it in the least in consonance with the physical law of our nature; in harmony with our moral nature, the law of God or is it even in harmony with the law of disease, in the physical organism, for I have shown that it is in all particulars a disease of the moral nature in the same sense that disturbing influences are disease in the physical organism. What is done for the man who is physically diseased? He is put on a strict diet. He is fed with substances that experience has shown modify the course of life, and bring it back to a state of health. Do we do anything like this for the criminal class? Do we not do for them, what was done three thousand years ago for the leprous. Nay, what in barbarous nations is still done for them, put them off by themselves till they end their mortal career.

If a man breaks his arm or leg, fractures his skull, cuts his flesh, opens a large blood-vessel, we at once seek out a man skilled in putting the bones in proper position, closing the gaping edges of the wound or stemming the purple tide, and having all done that could be, to promote a return to a state of health. We not only give that injured part rest, but the whole body; that the whole of the vital power may be directed, as far as possible, to effect the needed repairs.

Opiates are administered, to relieve pain, and all means known, to promote rapid and healthy repair, are resorted to, in order not only that he may be healed, but healed speedily, and with the least injury possible to the rest of the body.

But cases do occur where a portion of the body has to be removed, in order to save the rest from deadly infection, as a mangled limb or cancerous breast, etc. No such exigency, however, can arise in the body politic. Complete segregation is always possible, without death. We feed the consumptive on a diet that experience has taught us restores the wasted tissues. The rheumatic or gouty are fed on agents that promote more complete breaking up of disintegrating tissue, and again bring about a right state and composition of the blood. The dyspeptic has supplements for his wasted secretory organs, the tired man *rest* for his aching limbs.

But the sickly or diseased morally, in the body politic, are, as soon as they go astray, thrust in a crowd, into a dungeon; not only get no restoring agents for their sick morality, but are aggregated—mingled, in such a way—as to secure complete contamination of the whole mass of such beings. The novice in crime, with the most hardened criminal. What *could* be expected but that the novitiate will come out a thoroughly trained criminal. It is as if when a consumptive became ill, his friends should shut him up in a damp cellar, and feed him on the worst and most unwholesome food they could find for him. Nay more, expose him at the same time to the malign contagion of every other disease and *thus* expect to cure him.

What would people say, if the large hospitals in any of our cities were conducted on such principles? Would there not be a cry of indignation, from one end of the land to the other? But that is exactly what is being done for the morality of every prisoner who is sent to a prison, throughout all this enlightened land, despite its boasted culture, intelligence, and refinement.

The statistics of crime come in here to verify my statements; showing from year to year an increase of crime despite the increase of learning. Man is not naturally vicious. It is a disturbing influence thrust into his nature. And, that like a deadly contagion spreads from individual to individual, and from community to community, and our prisons, in place of being moral hospitals, for the restoration to health of such, are nothing but pest-houses or, we might almost say, training-schools for criminals. Those persons have inherited strong passions—which is always necessary for a strong morality. But crime comes in with its distorting hand, and no sooner touches the opening bud of human existence, than the flower changes from the rose of Sharon to Deadly Nightshade, and the fruit will be as apples of Sodom ripening only for bitterness, and death.

Neither are all persons, arrested and imprisoned, criminals, even though they may have committed a breach of the law of the land. He only is a criminal who is a breaker of the law after mature deliberation. The man we now regard, and punish as the worst criminal—the murderer—is not always, nor indeed often, a premeditated criminal. More often than otherwise, he perpetrates this terrible crime in a passion, or on the impulse of the moment. He is thrust out of society

—probably with justice—for he had lost complete control of his passion and should be disciplined thoroughly. But to a mortal pest-house he should not be sent. For if he was not a criminal when he went to prison, he will most certainly be one when he comes out. His prison-life has made him ten-fold more the child of hell, than he was before.

But I am told when advancing these arguments, that society must protect itself. Certainly! but we don't put patients infected with small-pox, measles, scarlet-fever, typhoid-fever, cholera, yellow-fever and every other contagion into a den, and there let the poor wretches die and rot in one great festering charnel-house, in order to protect the community from the contagion. We have places arranged on the best principles known to sanitary science for curing them, and we give such remedies as modify the course of, or cure the disease itself.

Now would it not be much more rational to do this for the morally diseased? Would it not be cheaper for the State? And would it not do more toward stamping out crime, than all the laws that are, or can be put on the statute-books of the land? And is it not the *true scope* of *civil government?*

Government in this country is an organization of the people for mutual protection and mutual benefit, "for the people and by the people," and for securing the greatest good to the greatest number. They then have the right to separate from their number any and all that may injure or contaminate them; for they are disposers of the rights of others when they affect the rights of the community. For the individual only gives up to the community his communal rights, not his individual rights, and that communal society can only hold him to account for acts that are against the interests of the community.

They have the right then to separate, for purposes of moral sanitation any diseased member, but they have no power to inflict a penalty—in the sense of retribution for breaking law. Man never has, and never can delegate individual rights. He is morally responsible to but One—the Author of his existence—and by Him, and Him alone, can a penalty for moral turpitude be exacted. God has declared: "Vengeance is *Mine,* I will repay." Man may not lay his hand on his fellow's throat and say, For your crime you shall suffer, this or that. God alone holds to account the breakers of law *by a penalty.*

But we profess to be actuated in our social relationship, and government by the law of the gospel—the law of love. Fear never has, and in its very nature never can prevent crime. The essence of crime consists in the *desire* to do a wrong. To prevent crime, then it is necessary to so instruct the moral nature, educate it—that virtue and morality shall appear desirable, that it is advantageous, and will eventuate in perfect happiness, that from the very nature of their life "The wicked shall not live out half their days." Not because God in His word has said so, not because he is ready to punish sin and crime; but from the nature and organization of the human family. The grand organic law of our being is the law of love. It is the key note of all organized existence. You may call it affinity, or selection, or choice, or love. They are only different expressions of the same thing. The plant takes—selects—from the soil what it requires—what

it loves—to array itself in a glory more gaudy than Solomon. The tree does the same thing in donning its verdant garb. The law of its nature teaches it to select just such substances as are best for its growth and development. It is fulfilling the law of its physical life. Why can we not do for moral nature, what they do for their physical nature, squaring our lives by this law of love.

We have by consent resigned to the church the sole duty of instructing in morality, but how poorly and miserably the large proportion of the professedly Christian ministers teach this law of love, needs no comments from us. One faction is well pictured by the poet Longfellow in Kinnellworth Tales.

> " The parson too, was there, a man austere,
> The instinct of whose nature was to kill;
> The wrath of God he preached from year to year,
> And read for pastime ' Edwards on the Will.' "

Another faction seeks by emotional excitement to gather adherents—to make proselytes—from the world. And when they have so made him " he is ten-fold more the child of Hell than he was before." Another faction teaches abnegation to the functionaries of a sect as meritorious and taking the place of this grand law of existence, love as a basis of morality. But there is still a few, bound by no creed, owning no sect or name, who believing in the *power* of this law, not only square their own lives by it, but from day to day, teach it from the sacred desk. Having no text-book they fall back on the Bible—the book that alone pretends to teach this law,—and yet our school legislators have excluded it from our schools. We are forgetting in our boasted enlightenment how much we owe to the promulgation of this law. Is there not fear that we may wander back into barbaric night and heathen ignorance, in thus despising the only text-book on morality in existence? In thus putting under a bushel the only lamp of morality? The lamp of life? Love?

What then in the light of these truths is the duty of every right thinking member of society? Is it not to demand as a first principle, that this organic law of morality, be systematically taught in all our public schools, and colleges? It is what pertains to society. It is part of the communal right, of the individual. Not his individual right alone. Education without this is a failure. It is as if a man were given a giant's strength and only the knowledge of a child to direct it, or a ship with powerful engines to propel but no rudder to guide it. The possibilities are all present in every man, the right directing agency only is wanting, *love*—not a sickly sentimentalism, not pity, but love as a *power*, a power to control, enlighten, guide, restrain, and elevate. It has this power. For all we possess to-day of civil liberty, under an enlightened government, has been brought about by this means—is the result of the teaching of this law, imperfectly as it has been done. Shall we not then, as a people give it a wider scope, a more thorough and systematic trial? When the imperfect work has done so much, given us so much, shall we stop, content with what we have, or shall we not rather yield fully to this all powerful influence which

"In happy triumph shall forever live,
And endless good diffuse, and endless praise receive."

When we do this, and only then, shall we recognize that "God-likeness is profitable unto all things." That it is cheaper as well as better to teach people to be and do good, then punish them for doing ill, and that when they go astray, it is better to lead them back to the ways of virtue and morality than to *punish* them for having gone astray.

In this way, and in this way only, shall we bring about, what we so often pray for, "Thy kingdom come, Thy will be done." He is love, and His kingdom and power, is not physical force, but love. To do this effectively and systematically, it must be taught in our schools, taught in our colleges, taught in our literature and in every day life, as well as from pulpits and lecture stands. Our prison management must be schools for reforming, and not dens for punishing criminals. No life must be taken, for society has no right in *life*. None are so bad that they cannot be kept separate, even it may be for the whole of life. With proper training in most cases a truer appreciation of the object and scope of life will be obtained by criminals by the time set for the period of incarceration. If at that time they show no ability to control themselves, let the time of training be extended, and not as is the case now, send them abroad to again prey on society. In other words cure the moral distemper, no matter how much time it may require.

BOTANY.

HISTORY OF THE POTATO.

L. J. TEMPLIN, CAÑON CITY, COLORADO.

The common potato was unknown to the inhabitants of the eastern continent till after the discovery of America by Columbus. The potato known to the ancients, and that is spoken of by Shakespeare and other English writers, was not the common potato, but it was the sweet potato, Convolvulus Batata. The early history of the potato is involved in considerable obscurity, as the references to it by the historians of those times are quite meager and somewhat contradictory. A careful collation and sifting of the various references to this subject seem to justify the following statements:

The first reference we find to the potato in connection with European history is related to the first voyage of Columbus. When on the island of Cuba some of his men visited the interior of that island and there discovered maize and a root that was used for food, and that was doubtless the potato. On visiting the continent of South America, European adventurers and travelers found the potato

growing both in the forests and in cultivation. The wild potato was found growing in the Andean forests from New Grenada on the north to Buenos Ayres on the south. And it is now known to be abundant as far north as New Mexico, in the United States, where it is a common and important article of diet with the Indians of that region. Humboldt does not seem to have been successful in finding the potato growing indigenously in some portions of the country where others assert that it was found. He says that "the potato is not indigenous to Peru, and that it is nowhere to be found wild in the Cordilleras situated under the tropics. M. Bompland and myself herborized in the back and in the declivity of the Andes, from the 5° north to the 12° south, and informed ourselves from persons who have examined this chain of colossal mountains as far as the Le Pau and Oruro, and we ascertained that in this vast extent of ground no species of solanum with nutritive roots vegetates spontaneously. It is true there are places not very accessible, and very cold, which the natives call 'Parana de las Papas.'" But it seems that though these distinguished naturalists did not succeed in finding the wild potato growing in these regions, others were more fortunate. Meyer states that "if the potato had migrated from Chili to Peru it would probably have retained its Chilian name; but this conjecture is no longer necessary, for it grows wild in both countries. I myself have found it in two different places in the Cordilleras of these countries."

Hooker[1] states that Don Jose Pavon, in a letter to M. Lamhert, says that Solanum tuberosum grows wild in the environs of Lima and fourteen miles from Lima, on the coast, and I myself have found it in the kingdom of Chili. And M. Lamhert adds, "I have lately received from M. Pavon very fine wild specimens of Solanum tuberosum collected by himself in Peru. In Chili it is generally found in steep, rocky places, where it could never have been cultivated, and where its introduction must have been almost impossible. It is very common about Valparaiso, and Cruikshank has noticed it along the coast for fifteen leagues to the northward of that port; how much further it may extend north or south, he knows not." Mr. Caldcleugh, of Rio Janeiro, in sending some tubers of the wild potato to the secretary of the London Horticultural Society, writes as follows: "It is with no small degree of pleasure that I am enabled to send you some specimens of Solanum tuberosum, or native wild potato of South America. It is found growing in considerable quantities in ravines in the immediate neighborhood of Valparaiso, on the western side of South America, in latitude 34½° S. The leaves and flowers of the plant are similar in every respect to those cultivated in England and elsewhere. It begins to flower in October, and is not very prolific. The roots are small, and of a bitterish taste, some with red and others with yellowish skins. I am inclined to think that this plant grows on a large extent of the coast, for in the south of Chili it is found, and is called by the natives maglia, but I cannot discover that it is employed for any purpose.

1 Botanical Miscellany.

The mountain of Chancay is mentioned by Jenin and Pavon as a locality where the potato is to be found in a wild state.

From the foregoing it appears the native habitat of the potato is found in the valleys of the Andes Mountains and the table lands bordering on the Pacific, several species extending as far north as New Mexico. But the potato was found by the European explorers not only growing wild, but it was also found in cultivation in a highly improved state. It has been in cultivation by the old Aztec race from time immemorial. At Cuzco in Peru, Quito in Equador, and perhaps as far north as Mexico, it had formed an important article of diet to the aboriginal inhabitants of America long before the discovery of that country by Europeans. The varieties in cultivation were far superior to the wild varieties, these last being quite bitter and unpalatable, while the cultivated varieties possessed considerable excellence.

At just what period the potato was first carried to Europe we are not informed. Spanish adventurers doubtless carried it to that country at quite an early day. Certain it is that it was cultivated in Spain as early as 1550. From there it soon made its way to Italy, Burgundy and the Netherlands. It was, however, early introduced into Italy, directly from South America. The early Spanish and Portuguese adventurers being zealous papists, it is probable this new esculent was very early sent to Rome as a present to the Pope.

There seems to be a conflict of opinion in regard to the introduction of the potato into Ireland. One account credits its introduction into that country to a Capt. Hawkins, a slave-trader, who, it is said, carried it from Spain in 1565. But Sir Robt. Southwell stated before the Fellows of the Royal Society that his grandfather had introduced it directly from Raleigh. Again, the Irish have a tradition that it was brought to their country from France by a Catholic priest. The potato was introduced into England by Sir Francis Drake on his return from a voyage to the Pacific Ocean in 1565. On his way home he touched at the Virginia coast, and carried away the discouraged colonists from that place. Whether he obtained it on the west coast of America or from the colonists in Virginia we are left to conjecture.

Sir Walter Raleigh is credited with introducing the potato into England from Virginia in 1586. Some authorities, however, place it as late as the year 1623. A somewhat careful examination has raised quite strong doubts in my mind whether this is correct. Raleigh, it appears, did not visit Virginia himself at all, but merely furnished ships and provisions, and sent others out. The return of Sir Francis Drake with the colonists from Virginia, seems to have been the only chance for the introduction of the potato about that time. In 1589, Raleigh disposed of his interest in the new world, and from that time we have no evidence that he gave any attention to colonial matters. To my mind the more plausible theory is that he received some of the tubers that Drake had brought from his southwestern voyage, and having cultivated them one year, introduced them to the public as a product of the new country in which he was at that time greatly interested. Again, there does not appear any evidence that the

potato was to be found in Virginia at that time. It is not indigenous to that country, and if found there at all it must have been procured from Europe, which is contrary to both history and the requirements of the case.

Peter Cieca, in his "Chronicle," printed in 1553, says that the inhabitants of Quito had, besides mays, a tuberous root which they called papas, and which was an article of diet with them. Clusius, a botanist of Vienna, supposed this to be the potato, specimens of which he had received both from South America and from Flanders. Thomas Henriot, a mathematician, describes the potato of Raleigh as follows: "These roots are round, some as large as a walnut, others much larger; they grow in damp soil, many hanging together, as if fixed on ropes; they are good for food either boiled or roasted." The first figure of the potato was given by Gerarde, in his "Herbal" in 1597. He calls it the Batata Virginiana. He states that "the root is thick, fat, tuberous, not much differing in shape, color and taste from the common potato, save that the roots hereof are not so great nor long; some of them are as a ball, some oval or egg-fashioned, some larger, some shorter, the which knobby roots are fastened into the stalks with an infinite number of thready strings. It groweth naturally in America, where it was first discovered, as report says, by Columbus, since which time I have received roots hereof from Virginia, otherwise called Nurenbega, which grow and prosper in my garden as in their own country. The Indians do call this plant 'papas,' meaning 'the roots,' by which name also the common potatoes are called in those Indian countries. We have the name proper to it mentioned in the title, because it hath not only the shape and proportion of potatoes, but also the pleasant taste and virtues of the same, we may call it in English 'potatoes of America or Virginia.'"

What is here called the "common potato," was the sweet potato, which was the root in common use previous to 1600. This was the plant alluded to by Shakespeare in the "Merry Wives of Windsor," where Falstaff is made to say,

"Let it rain potatoes, and hail kissing comforts.

Gerard speaks of the round potato as a great delicacy, and recommends that it be eaten as such, and not as a common dish. In 1630, Parkinson published a figure of the potato along with other roots that were eaten. It seems to have been quite rare in England for many years after its introduction. So little attention was given to this plant that it was not mentioned by Loudon and Wise in the edition of their "Complete Gardener," published in 1719. Bradley, who wrote on horticulture about the same time, says that: "The potato is of less note than horse-radish, radish scorganers, beets, and skerret." During the reign of James I. they were furnished to the royal table at two shillings per pound. And during the succeeding reign, and the Commonwealth, the potato continued very scarce and high in price. So slowly did it come into use that it was only toward the close of the eighteenth century that it came into common use. Hence we find that in Essex County in 1796, 1,700 acres were planted to supply the London market.

The potato made its way to Scotland in 1728, where it met with considerable opposition on religious grounds, because "the potato is not mentioned in the Bible." But a severe season in 1742, proved the value of this tuber for food, and so stimulated its culture that it soon became a common and reliable article of diet.

It was introduced into Germany in 1710. The government took quite an interest in its introduction, and in some parts of the country used compulsion to promote its cultivation. France received the potato about the same time that it was taken to Germany, but it seems to have met with quite strong opposition, having been pronounced poisonous by the National College of Physicians. One Parmentier, was instrumental in making it popular in that country. He first saw it as he returned from the siege of Mayence. He studied its cultivation in Germany, and on returning to France he entered upon the task of educating his countrymen in a knowledge of the value of this esculent. He exerted himself by every means in his power to attract the attention of the public to the merits of the potato as an article of food. It is true he overestimated its value, believing that it was equal to wheat. But he had not taken account of the value of gluten in wheat that had been discovered in 1727 by Bececaria. In order to overcome the prejudices of the people he wrote and spoke in its favor, recommending it to the poor as a cheap food product. He planted a field of potatoes, and, in order to impress the peasantry with its importance, he had it guarded by gendarmes, giving out that it was a very valuable food product. In a short time the guards were ordered to relax their vigilance. Some potatoes were stolen by the peasants, others followed, and finally the whole crop was disseminated among the people of the adjacent villages, and its excellence proved to be so great as to remove all the prejudice in regard to the tuber as an article of diet. Parmentier also secured the attention of the nobility to the value of the potato. On one occasion he appeared in the presence of Louis XIV. with a nosegay of the flower of the potato. The king inquired in regard to the plant, and was easily persuaded to introduce its cultivation into the royal gardens. The example of the sovereign was imitated by the courtiers, its popularity was thus secured.

Notwithstanding the efforts of those who appreciated it, the potato grew in favor very slowly, and did not become generally popular with all classes till the beginning of the present century. But when its merits were fuliy understood it soon became one of the most important food crops in cultivation. Such was the dependence of some of the people of Europe on the crop that when the rot appeared and destroyed the crop, it left the people in a destitute condition.

The destruction of the old varieties by this malady led to experiments in the production of new varieties to take the place of those that had seemingly lost their vigor. Mr. Goodrich took the lead in the production of varieties from the seed of the wild varieties. Though his success was not eminent he laid the foundation for improvements that have resulted in the production of hundreds of new varieties, many of them of very superior excellence.—*Gardener's Monthly.*

CHEMISTRY.

THE PRESERVATION OF WOOD FROM DECAY.

PROFESSOR F. W. CLARKE.

[*Read before the American Forestry Congress, April, 1882.*]

That the protection of wood from decay is one of the most important of industrial problems can hardly be denied; and yet in this country it has scarcely begun to receive proper attention. Our forests are rapidly wasting away, the price of wood is continually increasing, its applications are becoming more and more numerous, and still little is done. In 1855 lumber sold for about $18 per thousand, in 1860 for $24, and in 1865 for $45. Although a single acre of pine land yields on the average only about six thousand feet of timber, billions of feet are annually sold in the United States. It is estimated that the supply of white pine will be exhausted, at present rates, in about eight years. The question of preservatives will force itself upon our notice so urgently that it cannot be ignored. Prudence already insists upon a more rigid economy.

In Europe, much attention has been paid to the problem—England, France, and Germany taking the lead. In Great Britain alone not less than fifty patents for the preservation of wood have been taken out during the present century. To be sure, some patents have been granted at Washington, also, but their value is relatively slight. What is the consequence of this trans-atlantic superiority? Simply that railway sleepers, bridge timbers, and telegraph posts last more than twice as long abroad as in America, and that all other exposed wood has similarly gained in durability. Surely this fact is worth the attention of our practical men. Mere temporary cheapness cannot much longer pass for economy.

Many experiments demonstrate the advantage of protecting wood by chemical means. Prepared and unprepared timbers have been exposed together, and the overwhelming superiority of the former proved. A great variety of preservative methods have been found practicable, but an attempt to decide upon their relative merits is quite difficult. The material for criticism is bulky enough, but deficient in quality. All the desirable details are rarely given. A process which thoroughly protects one kind of wood may utterly fail with another. One method may succeed with seasoned timber, yet be useless for preserving green wood. Accordingly we find the most contradictory statements concerning every prominent protective process. One man finds it admirable, another denounces it as worthless. In order to get at results of true practical value, and to avoid these seeming discrepancies, we have to consider several things: first, the general

efficacy of each process; secondly, the kind of wood to be used, and its condition; thirdly, the expense, both actual and comparative; and fourthly, the particular use to which the wood is to be applied. The first and second of these questions can be settled only by the evidence of actual tests. The matter of expense involves, to some extent, the subject of locality. The fourth question opens up considerations of this sort. Given two processes for preserving wood, one of which will protect for fifteen years and the other for only ten, the latter being decidedly cheaper. If, now, we are to deal with the timbers of a bridge, the first of these processes, notwithstanding its greater expense, may be the more desirable of the two. But if we are to lay down wooden pavements which will be worn out by the wear and tear of travel long before the cheaper preservative has lost its protecting power, then the latter, though the inferior process in general, is the better for our purposes. In other words, an expense which may be advantageously incurred in one case, may be wholly unadvisable in a second.

The decay of wood may be generally traced to one of three causes. It is due either to slow oxidation, to the ravages of certain minute animals, or to an action induced by contact of the fibre with the decomposing albuminoid substances of the sap. It has at times been ascribed to the growth of fungi; but as these have been found to appear only after decay has fairly commenced, this supposition may be set aside. The rapidity of the change, however, is much influenced by external circumstances. In perfectly dry places wood rots very slowly, and has been known to remain sound for hundreds of years. Completely immersed in water, except where it is exposed to the attacks of the teredo, it is similarly permanent. The piles of Old London Bridge were found to be good after having been down eight hundred years. But in damp places, or in places alternately wet and dry, especially where there are frequent and great changes of temperature, wood decays very quickly. This is the case with wooden pavements particularly. Snow, rain, sun-heat, and frost are ever at work upon them, and particles of fermenting animal matter, like horse-manure, are constantly getting in between the blocks, and making the difficulty of preservation greater.

Now, leaving out of account altogether the processes of drying, washing, boiling, and steaming wood, we shall find that four distinct classes of methods for its preservation have been proposed. The first class contains all those methods which deal simply with the surface of the wood, leaving the interior structure unprovided for. Every process of this sort consists merely in the application of some air-tight varnish to the wood, none of these varnishes being sufficiently valuable to warrant description here.[1] The second class of processes comprises those by which the surface of the wood is carbonized, and the layers immediately beneath are somewhat affected also. Three plans of this sort have been proposed. In the first, which has no recommendations, the wood is charred by immersion in strong sulphuric acid. The second plan is to dip the wood into mineral oil or naphtha, then, after withdrawing it, to kindle its surface, and allow it momentarily

1. The recipe for such a varnish may be found in *Scientific American*, Vol. VI.

to burn. The third process, and the one which has been the most thoroughly tested, is that of M. de Lapparent, as used in the dockyards of Cherbourg, Dantzic, and Pola.[2] A jet of flame from a specially constructed coal-oil lamp is thrown upon the surface of the wood to be preserved. The outer layer is carbonized, while the layers immediately beneath undergo a partial destructive distillation which results in the formation of antiseptic, empyreumatic substances within the wood. This method has been highly recommended for the preservation of ship timbers, but is manifestly inapplicable to cases in which numerous small pieces are to be handled, as with wooden pavements. The cost of the labor involved in carbonizing the immense surface of the necessarily small blocks would be unbearable. There is an improvement upon de Lapparent's process, due to Hugon.[3] The difference is in the construction of the lamp. The improved method has been successfully employed in France for the preservation of telegraph posts.

In the third class of processes we find all those whereby the wood may be charged with insoluble mineral substances, and so protected from change. These all depend upon the principle of double decompositions—the wood being successively impregnated with two solutions which are capable of precipitating each other. Methods of this sort were proposed by Gossier in 1828; Treffry, in 1838; and Fliselli, in 1840. In 1837, the Industrial Society of Annaberg recommended the use of water-glass and hydrochloric acid. Ransome seems to have reiterated this suggestion, possibly with modifications, in 1845. Burkes, in 1844, proposed water-glass and sulphate of iron; and Feuchtwanger has recommended soluble glass and lime-water. In 1846, Venzat and Banger suggested the use of sulphate of copper with caustic baryta. Muller[4] claims to have obtained good results with sodium phosphate and barium chloride; and Schweitzer[5] asserts that a combination of sodium sulphate and calcium chloride has merits. But Payne's process, brought forward in 1841, has been more thoroughly tested than any other in this class. Payne tried experiments with various saline couples, but especially with a mixture of the sulphide of barium or calcium, with the sulphate of iron. Sulphide of iron and the sulphate of the earth were of course formed within the wood. The process, however, was costly and imperfect, and is now pretty much, if not altogether, abandoned. The same may be said of similar double processes. I have cited these methods only for the sake of completeness.

All the preservative processes at present in vogue belong to our fourth and last class. They depend upon the injection of various antiseptics into the wood, and vary not only with regard to the antiseptic used, but also in the method of applying it. The simplest method of application is merely to soak the wood in the preservative liquid. Almost as simple is the device of boiling the wood in the antiseptic. At one time, Boucherie recommended absorption by the living tree. Deep cuts were made in the trunk near the roots, a sort of tank built

2 Dingler's Pol. Journal, 181, 42, 1866.
3 Dingl. Pol. Jour. 189, 456, 1868.
4 *Sci. Amer.* 25. 328, 1871. Dingl. Pol. Jour. 202, 290, 1871.
5 Dingl. Pol. Jour. 125, 121, 1852.

around them, and the tank filled with the solution to be used. Sometimes the tree, immediately after felling, was placed upright, with its lower end in a vat of liquid. In either case the preservative solution was drawn upward by the capillary force of the tree, and penetrated even to the leaves. According to Hyett,[6] a poplar tree, ninety feet high, placed thus with its lower end in a solution of crude acetate (pyrolignite) of iron of sp. gr. 1.056, absorbed about ten cubic feet of the solution in six days. In a variation of this method, the preservative was applied to the top of the recently cut log, being enclosed in a kind of rubber cup. Different sorts of wood were then found to be differently penetrated. Beech absorbed the antiseptic readily, poplar with less ease, and ash scarcely at all. Heart-wood of Scotch fir, says Hyett, resisted permeation entirely. But all these methods of impregnation have been supplanted by the process which originated with Breant, and which, adopted since by Bethell, Burnett, and Boucherie, has been made well-nigh perfect. The wood to be preserved is enclosed in a strong iron cylinder, from which the air is exhausted by means of a powerful steam pump. Then, under great pressure, the antiseptic fluid is allowed to flow in, and permeates the wood in a most complete manner. Of course, the cylinders vary in size, and different pressures are employed. The most convenient dimensions seem to be about thirty-five feet by five, and the suitable pressure, about 125 pounds to the square inch.

As for the antiseptics which have been applied by these various methods to the preservation of wood, the list is very long, beginning with the recommendation of tar by Glauber, in 1657. Coal-tar, vegetable tar, creosote, petroleum, bitumen, and the so-called "pyrolignite of iron," have all been employed. Rosin has been used for the protection of wooden pavements in Cleveland. Solutions of rubber in naphtha or bisulphide of carbon have been recommended, but are of course too costly. Munzing, in 1840, suggested the use of the refuse liquor of the chlorine manufacture. Tannin, extracted from peat moss, gave unsatisfactory results. An arsenical solution, obtained from arsenical pyrites, was found to be dangerous to the workmen. Lime, and the alkalies, according to Parnell, really hasten the decay of wood; lime, however, has been highly recommended by some writers, and possibly it may work very differently with different varieties of wood. The other agents which have been proposed as preservatives, are common salt, sodium sulphate, borax, saltpetre, potassium dichromate, sugar of lead, zinc chloride, zinc sulphate, verdigris, copper nitrate, copper sulphate, ferric nitrate, ferrous sulphate, corrosive sublimate, and the various agents used in the process commonly known as "creosoting." This list may not be quite complete, but it is nearly so. Some of these compounds have been found ineffective, and others, as for instance borax,[7] have not been sufficiently tested.

The value of salt as an antiseptic is well known, but needs farther testing with reference to the preservation of wood. For this purpose it seems first to

6 See Parnell's Applied Chemistry.

7 Recommended by Sigismund Beer. *Sci. Amer.* Vol. 18.

have been recommended by Volmeister, in 1798. It has some good effect, which is due partly, if not wholly, to its hygroscopic action. Examples of its efficacy may be found in many salt mines, whose timbers exhibit remarkable durability. Ships engaged in the salt trade remain sound, it is said, much longer than other vessels. But the best test of the preservative power of salt was made some time ago in Saxony.[8] Wood prepared with this substance was exposed side by side with some which was unprotected. The impregnated timber was perfectly sound at the end of thirteen years, while the other became unserviceable in two.

At one time, corrosive sublimate was largely in vogue, but it is at present little used on account of its high cost, and its deleterious effects upon workmen. As a preservative of wood, it seems first to have been recommended by Knowles and Davy in 1821. Kyan, whence the term "kyanizing," introduced it in 1832. In 1837 Letellier proposed to use it in connection with gelatin. The double chloride, $HgCl_2+KCl$, (procured by the decomposition of carnallite with mercuric oxide[9] has lately been used as a substitute. The corrosive sublimate is injected into the wood by steam power, the standard solution containing one pound of the salt to five gallons of water. Its value as a preservative agent is unquestionable. At Woolwich,[10] pieces of kyanized and unkyanized wood were buried together in a trench. This trench was filled with putrefying vegetable matter and fragments of wood affected with dry rot, the whole being covered with horse-dung. At the end of five years, the protected wood was found to be unchanged; while that which was unprepared was seriously affected in one year.

With regard to ferrous sulphate, statements disagree. It has had the tests of experience less thoroughly than some other more fashionable preservatives. It was recommended by Strutzlei in 1834, Earle in 1843, and Apelt in 1853. Bohl, whose results will be considered in another connection, has employed it simultaneously with creosote. Its mode of action is rather complex. Injected into wood, it finds enclosed there a certain quantity of atmospheric air The oxygen of this air is soon absorbed by the ferrous sulphate, basic sulphate and some ferric oxide resulting from the change. On one hand, it is said that this action is beneficial. The fibre of the wood becomes coated with mineral matter, and is so protected from decay. In opposition, it is urged that the wood is weakened by this reaction, and that it is far less completely protected from decay than by some other more familiar processes.

Copper sulphate—blue vitriol—must pass for one of the very best of the preservatives of wood. Its merits have been tested quite thoroughly, and some occasional failures in its action have been satisfactorily explained. Boucherie, who made experiments with a number of antiseptics, after getting poor results with salts of lead and iron, finally settled upon this agent as the best of all, and time has in many respects justified his decision. At first Boucherie impregnated the wood by the process of suction, which we have already considered, but finally

8 Dingl. Pol. Jour. 202, 174, 1871.
9 Wagner's Chemical Technology
10 Parnell's Applied Chemistry.

he adopted the cylinder of Breant. Unfortunately, however, copper sulphate is not applicable to wood under all circumstances. Baist[11] has shown that it fully protects only green wood containing much sap, and Boucherie, Jr., somewhat corroborates this statement. Kirschweger,[12] also, claims that freshly cut wood is best for treatment with this preservative. This may perhaps enable us to explain the failure cited by Dalpiaz,[13] who says that on the Paris and Rouen Railroad, the timbers of a bridge which had been prepared with copper sulphate decayed with unusual rapidity. Either the wood was in an improper condition when treated with the sulphate, or else the impregnation was not carried out conscientiously. One other point remains to be noticed. According to Koenig,[14] resinous woods retain this antiseptic better than those which are non resinous. From the latter the sulphate may be partly, at least, washed out, while in the former it seems to be fixed by the resin, probably in the form of some basic compound. The resin itself, however, is a preservative.

The testimonials to the efficacy of copper sulphate in preserving wood are quite numerous. In some of the German mines it has been found to give even better results than the zinc chloride.[15] But on certain German railways, where it had been employed for the protection of sleepers, it was found to attack the iron. On the other hand, it is said that if the sleepers be thoroughly dried after impregnation, no such objectionable result will follow. In 1855, the Jury of the French Exposition put forth an extremely favorable report concerning Boucherie's process, asserting not only its value, but also its superior cheapness over the plan of creosoting.[16] In 1846, about eighty thousand sleepers saturated with copper sulphate, together with some which were unprotected, were laid down on the Northern Railway of France. In 1855, nine years afterward, the prepared sleepers were as good as ever, the others having long been decayed and replaced by new ones. For preserving telegraph posts, copper sulphate has been similarly effective. The saving to French lines alone, up to 1855, was estimated at two and a half million of francs.[17] Examples of this sort could easily be multiplied, but one more will suffice. In 1868, Boucherie, Jr.,[17] exhibited to the French Academy specimens of wood which had been prepared according to his father's process, and exposed since 1847. These specimens, after twenty-one years of exposure, were as sound, as elastic, and as strong as when new, and readily yielded the reaction of the copper they still contained.

In England and America the chloride of zinc has probably been used much more largely than any other metallic salt for the preservation of wood. Having been introduced by Burnett in 1838, its application to wood is known as "burnettizing," and the wood thus prepared is said to be "burnettized." The solu-

11 Dingl. Pol. Jour., 162, 397, 1861.
12 Dingl. Pol. Jour., 122, 223, 1851.
13 Dingl. Pol. Jour., 120, 140, 1851.
14 *Sci. Amer.*, 5. Dingl. Pol. Jour., 160, 48, 1861.
15 Dingl. Pol. Jour., 202, 174, 1871.
16 Jour. Frank. Inst., 32, 1, 1856.
17 Comptes Rendus, 67, 713, 1868.

tion commonly employed contains one pound of the salt to ten gallons of water, and is injected by steam pressure in a cylinder like that of Breant. The same limitations which apply to the copper sulphate seem also to hold good of the zinc chloride, the latter compound having the advantage of cheapness, and being nearly, if not quite as efficient a preservative. Burnettized wood was found to stand the Woolwich test as well as that which had been kyanized. In Germany the chloride has been applied successfully to railway sleepers, bridge timbers, and telegraph posts, and also to the wood-work in some of the Hartz mines. Furthermore, it has been successfully used for the protection of wooden pavements.

One more preservative method remains to claim our attention, namely, that of creosoting. Bethell, in 1838, using a vacuum cylinder, injected into wood a preparation of coal-tar oil, known commercially as "gallotin." Since that time, peat and brown coal creosote, paraffine, pyroligneous acid, and the so-called "pyrolignite of iron," have been applied in the same way. The best of all the substances of this class, however, is the heavy oil or "dead oil" of coal-tar. That portion is chosen which boils at about 180° C., and depends, to a great extent, for its efficacy upon the phenol which it contains. This phenol coagulates the vegetable albumen, while the bituminous oils completely penetrate the capillaries of the wood, cover the fibres with an impervious coating, and protect them entirely from the action of water and air. Bohl[18] finds that the poorer the liquid is in oily matter the more readily it penetrates the wood. Since much of the creosote is easily washed out, he subsequently treats the wood with ferrous sulphate, in order to fix the preservative. Ferrous hydroxide is precipitated, which is gradually converted into the ferric hydroxide at the cost of such atmospheric oxygen and moisture as may have been retained in the wood. There are two main objections to the plan of creosoting timber. The first is that it is applicable only to winter-cut hard woods. In this respect it is just the reverse of the copper sulphate process. The latter protects green but not seasoned wood, the former preserves seasoned but not green wood (See the paper by Baist already cited). The second objection is based upon the amount of the preservative to be used. Lumber, properly treated, absorbs about eight pounds of the coal-tar oil to the cubic foot.[19]

At present Bethell's process is largely used in England. For the preservation of railway sleepers it is said to be employed to the total exclusion of all other processes. On the Buckinghamshire R. R. ninety thousand kyanized, burnettized, and payenized sleepers were laid down, with thirty thousand which had been creosoted, and the last proved the most durable.[19] In the mines of Prussian Saxony, Upper Silesia, Thuringia, and Saarbruck, coal-tar for the protection of timber is preferred to the zinc chloride;[20] and in an experiment by Price at Gloucester, England, when unprepared wood decayed in a year, kyanized wood

18 Dingl. Pol. Jour., 144, 448, 1857.
19 *Sci. Amer.*, 3, 186, 1860.
20 Engineering, 13, 30, 1872.

lasted for seven, and then rotted, while creosoted specimens were as good at the end of twelve years as at first.[21] As a general process, Bethell's, including its variations seems to be the best of all.—*Proceedings Ohio Mechanics' Institute.*

21 Dingl. Pol. Jour., 123, 146, 1852.

ENGINEERING.

THE ENGLISH MILE: ITS RELATION TO THE SIZE OF THE EARTH.

JACOB M. CLARK, C. E.

This itinerary, on account of its lack of geographical correlation, and singular dimension, has evoked much interesting discussion, and been the means of bringing to the surface, under new aspects, a variety of important facts.

The reader is referred to a very instructive article in Vol. 25, p. 69, of this magazine, giving a full abstract of the views of M. Faye, as read before the Paris Academy, "On the Origin of the English Mile."

In that paper, the writer favors the view that the dimension is traceable to the survey of Eratosthenes, compared with that of Ptolemy; and, incidentally, that the surveys were conducted in terms of the Babylonian degree, and by implication, for the purpose of determining its length, or rather the subtense of one minute of arc; that the error in dimension arose partly from misapprehending the relative values of the stadia of different epochs, through disregarding the assumption that the computation of Eratosthenes was based on surveys made with the Egyptian foot[1] (0.27m. = 10⅜ inches), while the survey of Ptolemy was based on the Philetærian foot (nearly 0.36 m. = 14⅛ inches).

Much additional light is thrown on the subject through a valuable contribution to these pages, from the pen of Prof. Mansfield Merriman ("The Shape and Size of the Earth," *Van Nostrand's Magazine*, Vol. 22, p. 53–62, 115–128, and 233–241). Reference is more particularly made to the different versions of the earth's circumference by ancient mathematicians on page 58. In the absence of direct evidence to the contrary, the results, the definition of amplitude observed by Eratosthenes, and the chronology,[2] as given by Prof. Merriman, must be taken as clear and conclusive.

1. The Egyptian foot is uncertain. The dimension above given agrees very fairly with the ady of Malabar, the palmo of Malta, Messina, Naples, Sardinia, and Nice, the pied of Rouen, the stonecutter's schuh of Zug, and the miner's spanne of Prussia; dimensions varying from 10.265 to 10.570 inches.

The Philetæric foot is quoted by Alexander as equivalent to 13.898 inches.

2. In a recent discussion (Trans. Am. Soc. C. E., Vol. XI, p. 415), the writer, adopting this chronology, inadvertently placed Aristotle 200, instead of 100, years earlier than Archimedes.

Hitherto, the moderns have regarded these statements as the results of successive experiments by the ancient geometers, to ascertain what has been supposed to be unknown to them—the length of the terrestrial degree, or, at any rate, the true circumference of the earth; and, on the face of it, the discrepancy is certainly glaring enough to justify the impression, and, at the same time, to suggest the theory both of serious errors in their work, and confusion among them as to the dimensions of the stadia used in the different surveys.

The true character and object of these operations can only be understood by reading them in the light of contemporaneous history and in view of the spirit of the times, aided by such knowledge of the actual dimensions made use of as can be obtained or fairly inferred.

It should be borne in mind that, as a rule, conquest has always involved more or less serious interference with the metrics of the people. And, from the nature of the case, this was a prominent feature of state policy among the ancients. So long as a subjugated, but powerful and intelligent people retained the use of their traditional measures, cherished by the philosophers, and indissolubly connected with the mysteries and service of the temple. their complete subjection would be a matter of doubt. But the perils involved in the sudden and arbitrary overthrow of entire systems, were generally, in fact, sought to be avoided by modifications—compromises, under more or less specious and flattering pretexts.

Now as to the measures—the stadia probably used—and the mode of reckoning:

The Greek stadium was $\frac{1}{8}$ of their mile of 1,000 paces, or double parade-steps; value = 604$\frac{3}{8}$ feet. The Romans had practically the same mile. Elsewhere, the stadium was 100 fathoms, and the fathom generally, 3 cubits. But the Hebrew fathom was 4 cubits.

The Egyptian, Phenician, and Persian cubits was $\frac{1}{100}$ of the schœnus, which was equivalent to $145\frac{92}{100}$ English feet. The Hebrew cubit was $\frac{1}{80}$ of the schœnus.

The Babylonian cubit was apparently the subtense of 1° on a radius of 100 duodecimal feet, or 1,200 inches. Its value would depend on that of the inch. A form of it appears in Egypt, with some uncertainty as to the date of its introduction, under the name of the royal cubit. The Turin and Nilometer cubits, so called, are versions of it. The dimension was not far from 1.75 feet. A slight modification, to be understood further on, would place it at 1.75104 English feet.

There would result:

The Egyptian stadium = $437\frac{76}{100}$ English feet.
The Hebrew stadium = $729\frac{6}{10}$ English feet.
The (supposed) stadium on fathom of 3 Hebrew cubits = $547\frac{2}{10}$ English feet.
The (supposed) stadium on fathom of 3 royal cubits = $525\frac{312}{1000}$ English feet.

Among the peoples concerned, the reckoning, for all general purposes, was

purely decimal, except that the Babylonians had the duodecimal mixed up in their system, with alternations of 6 and 10.

To facilitate the view, the different results are arranged in the table in chronological relation with prominent epochs, and in connection with the above lengths of stadia:

Epoch.	Event, etc.	Earth's circumference in stadia.	Length of stad. English feet.
B. C. 538	Babylon taken by Cyrus.		
B. C. 525	Independence of Egypt destroyed by Cambyses.		
B. C. 340	ARISTOTLE	300,000	437.76
B. C. 332	Macedonian Conquest; end of the Pharaohs.		
B. C. 250	ARCHIMEDES	300,000	437.76
B. C. 230	ERATOSTHENES	250,000	525.312
B. C. 146	Greece made a Roman province.		
B. C. 90	POSIDONIAS	240,000	547.20
B. C. 30	Cleopatra's death; end of the Ptolemies; Egypt becomes a Roman province.		
A. D. 170	PTOLEMY (in the reign of Marcus Aurelius)	180,000	729.60

With these values of the stadium, the circumference in each case is 131,328,000 English feet.

By Clarke's elements of 1878, as quoted by Prof. Merriman, the mean circumference is 131,331,455 English feet.

The skill and accuracy of ancient astronomers is strikingly illustrated by the survey of Almamoun, in Mesopotamia, in the 9th century, referred to for illustration by both Prof. Merriman and M. Faye. Taking the Arabian mile (palpably a version of Ezekiel's 500 reeds) at Haswell's quotation, 2,146 yards, with the Professor's statement of the result, 56⅔ miles to the degree, the circumference is $2{,}146 \times 3 \times 56\frac{2}{3} \times 360 = 131{,}335{,}200$ feet, a trifle above the ancient and modern, in a total disagreement as to the whole circumference of less than a mile and a half.

Both Egypt and Mesopotamia are fairly situated for apprehending the mean circumference by meridian observations.

Leaving aside. for the moment, the above suggested adjustment of the royal cubit, the question arises pretty distinctly whether the most promising theory to square with all the facts may not, after all, be something like this:

(1.) At the very earliest assignable epoch, the mean circumference of the earth, and consequently its radius, were known with astonishing precision. Under a very perfect system of geometry, the metrics of the ancient leading nations were founded on this knowledge. The opinions of Aristotle and Archimedes were derived from this source, through Egypt.

(2.) After the Macedonian conquest, it became apparent that, by the breaking up and commingling of nationalities, the multiplicity of units was inconven-

ient and perplexing. The Mosaic and Babylonian cubits were in collision. The "cubit and a hand-breadth" of Ezekiel, by this time widely diffused and popularized, differed from the two-feet rule by about an inch. The Egyptian and Persian cubit was becoming confounded with the Indian[3] cubit of eighteen inches. And the Greek measures were a new element of discord. Eratosthenes was charged by Ptolemy Philadelphus with the work of reform. To satisfy the prevailing preferences for the decimal method, and at the same time strike a reducible mean among the cubits, an itinerary was invented which should be an even decimal of four terrestrial great circles. It is more than probable that the survey of Eratosthenes was simply to test the correctness of the ancient standards, and fix the adjustment of the royal cubit. The circumference was already known, according to the Egyptians, and if their account proved correct, the *relation* was apparent beforehand. The royal cubit would have to be $\frac{6}{5}$ of the Egyptian $= \frac{24}{25}$ of the Mosaic=1.75104 English feet.

(3.) This unwieldy division of the circle, unfit for geography or astronomy, along with the strong preferences of the Egyptians, Persians, Hebrews and kindred races for the ancient measures, and their wide-spread traditional sympathy as against Babylonian methods, finally broke this system down. Accordingly, after the Roman supremacy was established, and in the reign of one of the later Ptolemies, Posidonias restored the Mosaic cubic, but in a 3-cubit fathom, so that his itinerary was decimally related to the hour angle. And so far from his survey being the worst measurement of a degree ever made, it serves to verify in a very lucid way the work of his predecessors. The aptness of his system, as an itinerary, is attested by the survival of the Turkish mile, through all vicissitudes, and of its correlative fathom, by dozens of analogues, in the islands and along the Mediterranean and in Central Europe. And it may seem significant to many that in the Apocalypse, written 186 years later, the division of the circle by 24 is paramount.

(4.) Finally, in the reign of Marcus Aurelius, a further attempt at unification seems to have been made, by re-instituting the Mosaic itinerary—the leuga of the ancient Gauls and the mile of Sardinia. This was the survey of Ptolemy. Possibly it involved some concession to the Egyptians, in that the schœnus became simply 20 fathoms, instead of $33\frac{1}{3}$ as by their ancient method, or $26\frac{2}{3}$ as by that of Posidonias. It lacked, however, the key-note of Ezekiel's reform—radius to be the base of direct and square measure, itinerary to be ruled by the division of the circle.

There seems to be little, either in the accounts we have, the necessities of the case, or the character of the rulers under whom these operations were con-

3. It is a peculiarity of the purely duodecimal method that, reckoning from the inch, it has no longer dimension than the 12-feet pole or "joktan." And, wherever it has taken root, this dimension, as well as its derivatives by bisection, the vulgar fathom, the yard, and the Indian cubit, as also the foot, when used as units, are, as a rule, but with occasional intermediaries of 3 and 6, reckoned upwards decimally. Its singular distribution—about the Meridian, among the islands, as Great Britain and Japan, and upon the salients of Africa and Asia—are strikingly suggestive of the maritime enterprise of busy Tyre.

ducted, to indicate that they were instituted for any other purpose than that above suggested—verification of the ancient work, and adjustment of the standard for the particular purpose in view at the time. Neither is it apparent that in any of them, the Babylonian degree was either used or its dimension sought (except possibly as to Ptolemy), or that the Egyptian foot, whatever it may have been, or the Philetærian foot or the Greek stadium were used or referred to at all, or that the geodetic work had any other fundamental base than the ancient public surveys of Egypt, familiar to the learned throughout the whole period of operations, and unquestionably made with the schœnus. And this view is confirmed by Eratosthenes' definition of amplitude, as quoted by Prof. Merriman—$\frac{1}{50}$ of 4 right angles—a decidedly decimal expression as well as by the general ancient preference for the decimal method.

The English mile, by its dimension, suggests with strong probability that it was at first either equal to 1751 yards, representing the survey of Eratosthenes, or else 1824, like the Turkish mile, the itinerary of Posidonias; and that it took its present form at the time the English forced the 36-inch yard into their land measure, by means of the invention of Gunter's chain. The former is the more probable of the two.—*Van Nostrand's Magazine.*

ASTRONOMY.

METEORS.

R. J. M'CARTY.

History records many instances of the fall of masses of stone, iron, and other substances from the higher regions of the atmosphere. Until the beginning of the present century these records were regarded by many as either entirely mythical or based upon some events entirely susceptible of explanation from local causes, so that there was hardly sufficient faith in the fact to stimulate the philosopher to search for the cause. But when on April 26, 1803, near L'Aigle in Normandy, a shower of stones followed the explosion of a fiery globe which rushed with great velocity over that region, and when this fact was officially verified by a commission of the French Government, there was left no room for doubt that meteoric light is often followed by the precipitation of matter to the earth.

From observations made of the instants of appearance and disappearance of the light and of the position of its path with respect to the stars, astronomers have been able to calculate that the source of meteoric light lies always within the limits of the atmosphere and that the velocity of the meteor varies from seventeen to thirty-six miles per second.

It is, therefore, impossible to doubt that meteors are masses of matter rushing with tremendous velocity through the air.

But this amounts to little more than a definition and does not explain the physical causes of the phenomena, and the questions arise:—Whence the light by which we know the meteor, and whence the matter of which it is composed?

Now it is known that resistance to motion will always generate heat and that great heat is always accompanied by light. For instance, an axle or journal, if not properly lubricated, while rapidly rotating under great pressure, will become red-hot, and the reason it does not become red-hot when lubricated is that the oil reduces to a great extent the resistance due to friction and at the same time absorbs the heat generated by the resistance which it is not able to destroy.

Moreover, we know that the atmosphere offers resistance to the passage of bodies proportioned to the squares of their velocities.

Experiments in gunnery show that a fifteen-inch shot moving with a velocity of 1,500 feet per second encounters an atmospheric resistance of about one and one half tons If such a shot could be given a meteoric velocity of thirty miles per second, equal in round numbers to 150,000 feet per second, the resistance would be increased to about 15,000 tons. The quantity of heat generated by such a resistance under such circumstances is unknown, but, reasoning by analogy from the above instance of the red-hot axle, it seems perfectly reasonable to conclude that sufficient heat would be evolved to ignite and perhaps dissipate many rigid and practically incombustible substances. It is therefore generally conceded that meteoric light is caused by heat developed by the atmospheric resistance incident to the great velocity with which such bodies are known to move. If the meteor is composed of matter sufficiently fixed a portion of it often survives the great heat and falls to the ground in a highly heated state. If it is composed of more inflammable material it is consumed and dissipated in the air, which explains why we may not expect a meteorite from every meteor.

Respecting the origin of meteoric matter many theories have from time to time been advanced. For instance, it was supposed by some to be formed by the condensation of vapors of various substances in the air in a manner similar to that by which hailstones are produced from the vapor of water. The absurdity of this is manifest. LaPlace, with more reason, supposed that such matter was cast from the Moon by volcanic action with such force as to be brought within the limits of terrestrial gravitation, and indeed considering the absence of atmospheric resistance on the Moon (for that luminary has little or no atmosphere) and considering that the force of gravitation at the lunar surface is but one-fourth what it is on the earth, it is not impossible that the tremendous volcanic action peculiar to the Moon might accomplish such a result; but, as will appear further on, such a supposition is incompatible with the general facts attendant upon meteoric phenomena.

It happens that mechanical science is able to demonstrate that meteoric matter is entirely foreign to the earth or Moon, thus—

The greatest velocity with which a body, moving under the action of terres-

trial gravitation alone could possibly strike the earth, would evidently be attained by letting the body fall from an infinite distance—and it is demonstrated by a well-known theorem in dynamics that under such circumstances a body would strike the earth with a velocity of about seven miles per second; but we have seen that meteors move with velocities varying from seventeen to thirty-six miles per second, so that they must have a velocity not due to the earth; which is but another way of stating that they must have a planetary motion.

Therefore meteors are cosmical bodies; that is bodies having their origin in the same general cause which produced the Sun, Moon and stars, so that they may be regarded as minute planets or comets moving around the Sun, obeying the same laws and controlled by the same forces which order the motions of the most gigantic planet of our system.

When we consider that between the orbits of Mars and Jupiter there are more than two hundred small planets, varying in size from two hundred and fifty to sixteen miles in diameter, and that others are being discovered every year, it seems entirely reasonable to conclude, even without reference to meteoric phenomena, that there are myriads of such bodies belonging to the solar system so very small that they can never be detected.

And meteoric phenomena show that the orbital motions and positions of these small bodies are such as occasionally to bring them within the dominion of terrestrial gravitation, whereupon they are drawn from their orbits toward the earth with increasing velocity, and striking the atmosphere burst into flame from the causes given above.

However satisfactory it may seem in explaining the ordinary meteor, which may be seen on almost any clear night, to flash like a rocket across the sky, it would be spreading the above reasoning over too much surface to extend it to those periodical phenomena, called meteoric showers, which make it appear as if all the stars in the heavens were being precipitated upon us.

It having been observed that all planets revolve around the Sun in the same direction and nearly in the same plane, and that the Sun himself rotates in the same direction about an axis nearly perpendicular to the mean position of the planes of the planetary orbits, the suspicion arose that this could not be the result of chance, and that therefore the mechanism of the solar system must derive its motions from a single physical cause—and indeed it has been demonstrated that the probability for a single cause for 228 planets moving in the same direction around the Sun is $1-\frac{1}{2^{228}}$ in which 1 represents certainty. The fraction $\frac{1}{2^{228}}$ when developed would be represented by 1 divided by a number of sixty-nine figures, so that the value of the fraction would be almost nothing, which shows it to be a practical certainty that such motions are the result of law and not chance.

The attempts to discover this law directed somewhat by the suspected existence of gaseous nebulæ, culminated in the nebular hypothesis, which resting as it does upon such a high degree of probability, conforming so entirely to natural law, and explaining so many phenomena entirely inexplicable on any other theory,

may be regarded as established as fully as any speculative principle can be without becoming a fact or truth.

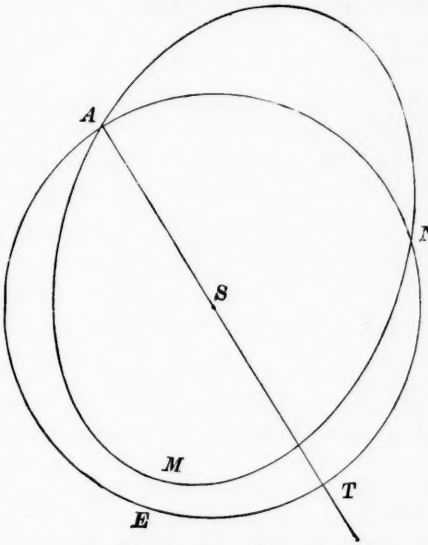
Broadly stated, it is as follows: At one time all the members of the solar system were united in a single mass of blazing matter rotating about an axis nearly coincident with the present axis of the Sun, and, by reason of the expansion due to excessive heat and the operation of centrifugal force, extending its lenticular form far beyond the orbit of the outermost planet. By the process of cooling, the action of centrifugal force, and the law of gravitation, the outer portions of this chaotic mass became detached from the main body and broken into small fragments, thus forming an immense annulus, each member of which revolved around the original mass, just as planets revolve around the Sun. Some of these fragments afterward became united by gravity and collision and the result was a larger mass continually increasing in size by absorbing its smaller neighbors just as the earth now absorbs meteoric matter, and still revolving around the original mass. By a repetition of this process at the different stages at which the centrifugal force, increasing with the increase of velocity due to the gravitation of the denser portions of the nebula toward its center, would balance gravity, the solar system as it now stands was formed, the Sun being the remnant of the original chaotic mass—all of which, judging from the behavior of matter under somewhat analogous conditions here on the earth, is in perfect conformity with physical law.

Now unless we are prepared to combat the Nebular Theory we must admit that at certain epochs of its development the solar system was swarming with millions of small meteor-planets; that these have either all been since consolidated into the masses of the few larger planets or that there are some still remaining, which, owing to their peculiar situations and motions, have escaped the clutches of their more powerful neighbors.

The latter is by far the most reasonable, since it is difficult to conceive how all these small bodies moving as they do, could be absorbed by the larger in any finite time—and here it may be well to remark that it must be owing to the great distance between the orbits of Mars and Jupiter that the asteroids have not been appropriated by one or the other of those planets, and to the peculiar positions of their orbits that they have not been united in a single mass. The Nebular Hypothesis therefore permits us to assume, if it does not force us to believe, that not only are there many small isolated bodies revolving around the Sun as planets, but also that these bodies revolve in groups and even in continuous rings.

Suppose that one of these small bodies should revolve in an orbit of exactly the same period as the earth. It is evident that so long as this was kept up the small body would preserve its identity, but should its period be changed in even the smallest degree, it would become a question of time when the earth would transform it into either a meteor or satellite. Let S. represent the Sun; A. N. E. the orbit of the earth; A. N. M. the orbit of meteor planets; A. S. T. the line of intersection of the planes of the two orbits. Suppose a group of meteors to revolve in A. N. M. with a period differing from the period of the earth. It is

evident that this group of meteors and the earth would at some time reach the point **A.** at the same instant and the result would be a meteoric shower.



Such meteoric masses as were not absorbed by the earth in this rencountre would pursue their course and after a certain period some of them would again be caused to contribute to a similar meteoric display.

It is easy to see that this display would happen about the same time of the year and at regular intervals determined by the relation between the periodic times of the earth and group of meteors

Suppose now that A N. M. should represent the orbit of a continuous stream of meteors moving around the Sun like an immense ring. Every year when the earth arrived at A there would be a meteoric shower. This is what happens each year about August 10th.

Thus far we have kept within the limits of the solar system entirely in order to show that all meteoric phenomena could be accounted for within those limits.

But there are certain meteoric displays, notably those which appeared in 1799, 1833 and 1866, which cannot be considered as coming within the limits of the above reasoning, because it is known that the group from which these meteors emanate has a retrograde motion and moves in a cometary orbit. But this fact no more militates against our previous reasoning than do retrograde comets against the nebular theory. It only enlarges the scope of the inquiry and shows that while many meteoric masses are proper to our system many also wander to us from the remote depths of space.

From what has been said we conclude that meteoric phenomena are but the continuation of that process by which the solar system has for infinite ages been collecting the scattered matter from outer space and by which the planets have grown to their present size; that this process now retains but the shadow of its ancient vigor and will probably slowly fade and finally vanish in the great end toward which all creation tends.

KANSAS CITY, May 5, 1883.

A COLOSSAL ENGINE AT WORK FOR MAN.

EDGAR L. LARKIN.

It is known that if a balance-wheel revolves, the mass of the rim draws against the centre. If the wheel is heavy and in rapid revolution, the spokes restrain a powerful tendency of the circumference to break in pieces and fly away on tangent lines. Or, if we revolve a grindstone too rapidly, it will burst into fragments, each being hurled away on straight lines with great force. Indeed, should we have a solid mass of steel in the shape of a disc, say twenty feet in diameter and five feet thick, and hung on an axis, it could be burst in pieces simply by causing it to revolve with sufficient velocity! We are all familiar with this tendency called the *centrifugal*, and recognize it as being one of the most powerful energies developed by motion; while with the indulgence of the reader, we desire to present one of the most magnificent examples of its action, in the endeavor to impress the mind with some idea of nature's grandeur. We will present the case in its most elementary form, and ask that the student will follow in a computation that we promise shall not offer difficulties.

1st. The *acceleration* due to the centrifugal tendency of a moving body, is equal to the square of its velocity divided by the radius of its path. Let us take a rod of steel five feet long, attach one end firmly to an axis, and the other to a cannon ball whose weight is fifty pounds, then revolve the axis fifty times per second and compute the acceleration due to the centrifugal tendency. Since the radius of the circle traversed by the cannon ball is five feet, its circumference is 31.41 feet; and since the ball makes fifty revolutions per second, its velocity is 31 41$\times$50=1570 feet per second. By the rule—1570 squared=2,464,900 which divided by 5=492980 feet as the acceleration.

2d. The entire centrifugal tendency is equal to the acceleration multiplied by the mass of the body, and tension on the steel rod is proportional to the acceleration and gravity. The mass of the cannon ball is fifty pounds and the intensity of the earth's gravity is able to impart to a falling body a velocity of 32.2 feet per second at the close of the first second of fall. Therefore:—492,980$\times$50=24,649,000 which divided by 32.2=765,496 pounds tension on the rod! What bar of steel could withstand this enormous force? We see what tremendous power is developed by rotary motion, for here is a force of 383 tons evolved in a simple machine capable of being run in any of our manufactories, and moving with a velocity of only 1570 feet per second! Now let us make application. We will take a rod of cast-iron 92,882,917 miles long and fasten one end to a sphere whose diameter is 866,394 miles, and the other to a ball 7925 miles in diameter and set the machine in revolution. To the small ball we will impart a velocity of not a few feet, but a rate of 97,642 feet or 18.4927 miles per second. When the vast engine has attained its full speed, and is in revolution in regular circuit, then

let us calculate the strain on the rod of iron to keep the little ball from flying away.

Proceeding as in the case of the cannon ball, we divide the square of the velocity by the radius in order to find the acceleration of centrifugal tendency. If we square the velocity per second of the revolving ball and divide the square by 92,882,917 the quotient will be .00000368 of a mile or .233285 of an inch per second. By rule 2d the total centrifugal tendency or strain on the iron rod, will be equal to the acceleration multiplied by the *mass* of the moving ball and the product divided by the force of gravity exerted by the mass of the large sphere upon the small. The question now—before we can proceed—is to find the mass and gravity of the two globes in space.

We remark that our hypothetical spheres are none other than the Sun and Earth, as they actually exist in the solar system.

The diameter of the Sun	866,394 Miles.
The diameter of the Earth	7,925 Miles.
The diameter of the Sun	109.31823 Ratio.
The diameter of the Earth	1. Ratio.
The mass of the Sun	333,426.2356 Ratio.
The mass of the Earth	1. Ratio.
Distance between centres of Sun and Earth	92,882,917. Miles.
The density of water.	1. Ratio.
The density of the Earth	5.66 Ratio.
Weight of the Earth	6,743,610,190,383,705,901,809. Tons.

This weight of the Earth needs explanation, for considerable error is attached to its meaning. If we cut up the Earth into cubes, bring each, one at a time to the surface, weigh it and replace in original position, we would find, that if each block should weigh a ton, their number would be as given. The reason is, that each cube would be subjected to the attraction of the Earth's mass. Of course, if the Earth were the only mass in existence it would not "weigh" anything there being no matter to attract it.

The mass of the Earth in tons as above is simply its mass in relation to itself, and cannot be used in a computation seeking centrifugal tendency. We must have its weight in reference to the Sun, before we can find the tension on a rod assumed to hold them together. And this weight in relation to the solar mass we shall find to be quite different; and we must also learn the intensity of gravity exerted by the Sun's mass at the Earth's distance, because we see by the law that attraction is a factor in these calculations.

It is known that the force of gravity on the surface of a sphere is equal to its mass divided by the square of the radius.

The mass, radius and square of the radius, and therefore the gravity of the Earth, are each equal to 1. The mass of the Sun is 333,426, its radius,=109.-31823, the square of its radius,=11,950 whence, mass divided by the square of

the radius=333,426÷11,950=27.83. Therefore solar gravity is 27.83 times stronger than the Earth's; that is: a stone that would weigh one pound on the surface of the Earth would weigh 27.83 pounds on the Sun. Also, gravity exerted by the mass of a sphere at any distance from it, is equal to gravity on its surface divided by the square of the distance.

That being the case, let us learn how much solar gravity is weakened at a distance of 92,882,917 miles from its centre. The radius of the Sun is 433,197 miles; and 92,882,917 divided by 433,197=214.41248 whose square is 45,972.-71158. Now we have seen that the Sun's attraction is 27.83 times stronger than the Earth's, hence one ton on the Earth taken to the Sun would weigh 27.83 tons. Suppose we now take the 27.83 tons into space 92,882,917 miles from the Sun, how much would it weigh then? If we reduce 27.83 tons to ounces and divide by 45,972.71158 the quotient will be 19.37 ounces! That is, if we carry a stone that weighs one ton on the Earth, to the Sun, it will weigh 27.83 tons, and then if we remove it 92,882,917 miles away from the Sun into space, the great weight will dwindle to 19.37 ounces or a little more than one pound. Great results follow from this method of mathematical induction. Let us see. Why not take the whole Earth to the Sun? If we could, it would weigh 27.83 times as much, or 187,718,612,962,379,075,475,000 tons. Now carry the Earth back into space from whence it came, then each ton of its weight on the Sun's surface, would shrink to 19.37 ounces; the weight of the whole Earth dwindling in reference to its weight while on the Sun, to 4,083,261,651,590,510,370 tons.

Then using rule 2d to find the tension exerted on our imaginary rod of cast-iron, we must multiply this newly determined mass of the Earth (in relation to the Sun) by the acceleration and divide the product by the force of solar gravity exerted by the Sun on the Earth. The acceleration we found to be .00000368 of a mile per second; but a curious circumstance comes in here, which renders the problem different from our cannon-ball computation. This is: the acceleration is just equal to gravity, i. e. the Earth does not fly away from the Sun; nor does it approach, hence we need not multiply one number by another and then divide the product by the same, we do not change values. Hence a cable or bar that would be able to hold the Earth on its orbit, must be strong enough to hold a weight of 4,083,261,651,590,510,370 tons.

With what appalling force does the mighty mass of the Sun attract the Earth; and what manner of engine is this, that toils night and day simply that such beings as men might live a few days and expire? One-half of the Earth is turned toward the Sun all the time, and it is easy to find the number of square inches in the hemisphere. Suppose now that we attach the ends of a cast-iron bar to the Earth and Sun, and instantly let the Sun cease attracting, then the Earth would tend to fly away from its orbit on a straight line; and since this centrifugal tendency is equal to its weight (referring to the Sun), we find the force or pressure exerted on each square inch of the entire half of the Earth's surface to be 20,619 pounds, or 10.3096 tons. But cast-iron is capable of sustaining a pressure of only 18,656 pounds, hence a solid bar of this material 7,925 miles in diameter could

not hold the earth on its path, but would snap like a thread, sending our world headlong into frigid space. Of course, the weight of the bar itself has not entered into this reasoning. Or, if the Earth should stop in its orbit, it would at once begin to fall, and a mass of cast iron equal to its diameter would be crushed. What is this mighty engine for? Does it labor solely for our existence? Are we worthy of it all? Did God intend that such colossal power should be chained to the servitude of beings who slay one another in war? Does the gigantic Sun hold the world in place simply as an abode of creatures filled with vice, misery and debasement? Or, are beings out of harmony with God and His goodness fit for the home provided at such cost? Really, in our present state, we do not seem worthy; it appears unreasonable that such energies should struggle in ceaseless round,—all for us. The only reason we can see why such powers were assigned to our use, is that humanity will eventually advance morally and mentally, until they do become suitable beings to receive such manifestations of the Divine care.

NEW WINDSOR (ILL.) OBSERVATORY, May 10, 1883.

THE SUN AND PLANETS FOR JUNE, 1883.

W. DAWSON, SPICELAND, IND.

The Sun moves in right ascension about two hours each month. So his R. A. will be 4h. 37m. on June 1st at noon, and 6h. 37m. on June 30th. He passes the summer solstice (in R. A. 6h. 00m.) June 21, a few minutes after noon. This will be the longest day of the year—14h. 50m. in latitude 40°, along the north line of Kansas. On the south line of Kansas, 37°, it will be 14h 32m.; 18 minutes shorter than 3° farther north. On June 7, Regulus will south at 5 o'clock in the evening; but can be oserved with a small transit instrument. On the same evening Denebola will south at 6 41. Spica, the bright star in Virgo, souths on that evening at 8:16. Remember that all the stars south about four minutes earlier each day on account of the Sun's increase of right ascension, and this is caused by the Earth's annual rotation.

The Moon becomes new, or "changes," on the 4th near midnight—one lunar month after the great eclipse, May 6th. This time she will pass a little south of the Sun, and there cannot be an eclipse on the Earth.

The Moon will pass over Saturn again—producing an occultation—about 3 o'clock in the morning of the 4th; but too near the Sun to be well observed. She will pass near Spica on the 14th. The Moon's north edge will nearly graze a star of fourth magnitude on the 21st.

Jupiter still "holds the fort" as an evening star, though he is just approaching the eve of conjunction with the Sun. Saturn has passed the Sun and is now a morning star. Mercury, after so brilliant a display in May, has now shut him-

self up in the dazzling rays of the Sun. He will reach inferior conjunction with the Sun near midnight of the 7th; after which he will be morning star till July 20th.

Uranus occupies a good position for observation. It is about 5° nearly west of Beta in Virgo. It is just visible to the naked eye when the Moon is absent — like a star of sixth magnitude. Neptune is a morning star, and will be very near Venus June 8th. Both will be in the same field of view in a telescope; Neptune being about 10′ south of Venus. The latter is getting nearer the Sun and dimmer, but is still a prominent morning star about daylight. Mars on the 10th is an hour above Venus, but not of much prominence or interest. On the 19th Venus and Saturn will be in conjunction—Saturn being 35′ south of Venus.

CORRESPONDENCE.

SCIENCE LETTER FROM PARIS.

PARIS, May 5, 1883.

Boiler explosions are of late of frequent occurrence, and the conclusion of the inquiry into a catastrophe is, "cause unknown, the boiler was in a good state and the water at the proper level." The latter two explanations may be quite correct. Now the cause which escapes control is exactly what remains to be investigated. Professor Donny, of Ghent, in 1846, drew attention to the fact that water when freed from the air which it always holds in solution, boils no longer at 212°, but must be over-heated to some 256° before it reaches the ebullition stage. Then the transformation of water into steam takes place suddenly and in volumes, as that the vessel containing it bursts.

Thus there is water saturated with air normally, and water which on being progressively heated, parts with its air. In the latter condition when the temperature is augmented, no steam is generated, the air being no longer there to aid the work of ebullition. The fireman consults the indicator and finds the water to be at the same level; he concludes the temperature to be insufficient; he adds fuel upon fuel; the indicator remains still stationary. Suddenly the water having been over-heated, to 256°, immense volumes of steam are generated suddenly and an explosion follows.

The danger is at its maximum in the morning and at noon when the operatives resume work. About seven in the evening the fireman banks the fires, after having filled the boiler with water leaving the manometer indicating a pressure of four atmospheres. In the morning the pressure is down to say two atmospheres; it adds fuel to augment to six atmospheres. However, during the night the boiling water has gradually got rid of its air and has become dangerous, presenting

the conditions for exploding. The same observations apply to the rest the boiler enjoys during the dinner hour. Thus explosions mostly occur when the operatives are resuming work.

There is a relation between the temperature of the water and the pressure of the steam, hence the duty of the fireman ought to be to consult a thermometer and a manometer; if the two instruments disagree, the fires instead of being increased should be extinguished. Capt. Treve proposes that a tube be specially laid in the boiler, furnished throughout its length with conical apertures, along which the external air could be pumped; thus the water could be supplied with the air which it lost during the night and meal time. An electric apparatus could be made to communicate with the engineer's office, to register and signal all discrepancy between the thermometer and the manometer.

Salmon rearing has proved a success in Paris. In 18.9 some sa'mon eggs were received from California and placed in the tanks or basins of the Trocadero. The incubation was successful; the fry were fed on chopped whitings, and from half a pound weight increased to five pounds. Thus it is demonstrated that California salmon can be bred and reared in captivity under except onal conditions, as change of climate and habit. It is proposed to stock the southern rivers of France with salmon where it is unknown.

When one experiences a violent blow, the eye, from the effects of the shock, perceives an infinite number of sparks. Under certain influences the nervous system then experiences certain luminous vibrations. Indeed there are persons so sensitive that they cannot bear a sound or a noise without experiencing at the same time the sight of these colors. To the auditory sensation is united the luminous and the colored. Each sound has its peculiar color; such a word corresponds to red and another to blue, as one note may be green and another yellow. This phenomennon of audibleness and simultaneous vision is called "color-hearing." To Dr. Nussmaumer, of Vienna, belongs the honor of discovering the seeing-colors at the same moment that he perceived sounds. Others have since observed these colors when listening to notes of music. Equally strange, a melody played on a saxophone will create a yellow sensation, while on a clarionet, it will be red, and on a piano, blue. The compass thus of the sound exercises an influence on the phenomena. The energy of a sound corresponds to the intensity of color. The most brilliant silver-white colors accompany the shrillest whistle. The human voice determines a multiplicity of impressions: thus the vowels *i* and *e* produce on emission the most lively colors: *a* and *o* shades less brilliant, while *u* has a sombre tint. It is a curious fact that individuals who can thus perceive the colors of sounds fail to recognize those of their own voice.

Major Jouffret in his volume on the "Theory of Energy" states, that it is completely impossible for us to know the veritable essence of atoms; all we are certain of is that they are not immovable, that each molecule resembles a little solar system or like nebula in constant agitation. What is meant by the tenuity

of gas? for example. It is commonly regarded as the result of a kind of bombardment of petty projectiles against an enclosing envelope, and the rapidity of these projectiles is such as to confound the imagination. According to Jules, Clausius, Maxwell, etc., each gaseous molecule has a velocity peculiar to itself of 2,187 yards per second, and when turned aside by neighboring molecules, that velocity can be augmented seventeen milliard times. There are as many molecules in the compass of a pin's head, that if imagination could conceive counting them at the rate of one million per second, 250 millions of years would be necessary to complete the numeration; that is to say, had the calculation commenced when our solar system was in the nebulous stage, the addition would not be terminated even now.

Professor Crie has followed up his volumes on fossil botany, by a very interesting study on the "Primordial Flora." He traces the first vestiges of life in the strata anti-primordial of Canada, England and Sweden. But nothing is more difficult than an exact classification of the primordial vegetation, owing to the rarity of the proofs or specimens, their imperfection, and the difficulty to fix the true geological position of those strata where fossil remains exist. As an instance how widely opinions differ, some scientists view the fossil impressions not as belonging to plants but due to worms, crustaceous organisms, and even to inorganic objects which, driven by the waves, left their mark at the bottom of the sea. M. Rouat even is of opinion that many of the so called plant impressions are simply produced by gaseous emanations in the sands. This fact is certain, that however far back we go, we never find animal separated from vegetable life.

M. de Lesseps has no doubt as to the financial as well as the engineering success of the inland sea in Southern Tunisian and Algeria. The Mediterranean will be allowed to flow in through a canal to be excavated, some eighty miles long, and when the depressions are flooded, the sea will be in places seventy-five feet deep. As at the Straits of Gibraltar, the same current will be out-flowing as well as inflowing, and there is no fear of the depressions being silted up by the deposit of salt, as the sea water keeps such dissolved.

M. Launette holds a theory, that the sardine fishery off the coast of France is due to the direction of winter winds. According to him, the detritus from the cod fishing and curing stations of Newfoundland is carried to the west of France, where the sardines come to feed; now the last winter the winds were S.SW. and hence the detritus was blown into the Gulf stream, where the fish must go and seek it. Conclusion—the sardine-fishing will be bad this season.

M. Paul Bert has so far been able to mix oxygen with protoxyde of nitrogen or laughing-gas, as to make that anæsthetic now practically reliable; he has thus been able to keep dogs in a complete state of insensibility during half an hour, without any indications of asphyxia.

M. Wroblewski, a young Polish chemist, has succeeded in liquifying oxygen gas He produces the most intense cold as yet known, by boiling ethylene in vacuum, and then submitting oxygen to a pressure of 22 atmospheres, when the gas assumes a liquid form and is perfectly colorless, thus differing from ozone, which is blue. He has been equally successful with nitrogen.

Dr. Jules Guerin has performed some brilliant surgical operations, by employing caustics to destroy sensibility round the parts diseased. The caustic formed a skin wholly impervious to the fluids of the ulcers at the same time.

LETTER FROM FORT McKAVETT.

Robert Robinson, Esq., who lives near Fort McKavett, Texas, has furnished me some interesting facts that have come within his knowledge, in reference to centipedes and tarantulas. One evening in 1861, while living in the house now occupied by Major Jewett, he was leaning against the outside wall of the house, while standing on the veranda, when he felt something crawling over his hand as it rested against the wall. Springing away he got a lamp, and found it was an immense centipede. Taking the tongs he caught the centipede and put it into an empty glass jar, and placed it on the mantel. The centipede was in continuous motion day and night, but could not get out of the jar, although left uncovered. About three days afterward some member of the family caught an ordinary sized mouse, and Mr. Robinson put him into the jar with the centipede. When the mouse was introduced the centipede backed up and humped himself, as a cat sometimes does before it springs on its prey, and then seized the mouse with his forceps by the head between the eyes and ears, and crunched him down head foremost, the mouse entirely disappearing in twenty seconds by the second-hand of the watch. During this process the centipede showed his incisors like those of the fish head.

About two weeks after this, he caught a horned frog, and placed him in the jar with the centipede. The frog jumped about all night in the jar which was covered now, and there was a terrible racket, a kind of pounding, in the jar. In the morning Mr. Robinson took the jar out into the yard, and emptied it on the ground. The frog went off apparently uninjured, but the centipede gasped three times and died. He then measured the centipede, and found that he was ten inches and a half in length, a mammoth centipede for this locality. He had no alcohol, and as it cost about $20 a quart, he concluded not to preserve the specimen. The horned frog was undoubtedly protected in the terrible contest, from the poison of the centipede, by its hard thick skin which serves as a kind of armor.

Mr. Robinson has caught centipedes three inches in length, and thrown them into the nests of the fierce red ants which build houses of sand and gravel here. The ants would immediately cover them all over and bite off the legs of

the centipedes. Larger centipedes would have strength to crawl out of the nests of the ants, but when they were thrown back a few times, into the nests, the ants would disable them by eating off their legs.

These ants are so furious that a person will sometimes have to divest himself of his clothes for a few minutes to get rid of them, when he has unfortunately stumbled upon one of their nests.

Centipedes live under stumps, and dead pieces of wood, and in the walls of deserted houses. Mr. Robinson has lived in Texas twenty five years, and near Fort McKavett twenty-two years, but although several persons have been stung by centipedes, and bitten by tarantulas, he has never known any one to die from the effects. Tarantulas appear the last of April.

Mr. Robinson says the large red wasp that makes his nest of wood pulp on houses, will fight the tarantula and kill it. The wasps generally fight in pairs. Two wasps will attack a tarantula. As the tarantula is slow and the wasps are quick, they will dart upon it, and shake it as the terrier does a rat. Then they will fly off for a moment, and dart upon it again, and watching their opportunity, sting it. They seem to realize that the tarantula is a dangerous enemy, and are very quick, and careful not to give it a chance to bite them.

There is a ground-wasp here that lives in a hole in the ground. Sometimes they are three inches in length. They will capture the largest sized tobacco worms found here on tomato vines, and drag them to their holes in the ground. The dirt-daubers, the wasps which construct mud nests on houses, catch a black spider and put them away in their nests for their young. The boys use the larvæ of the red wasps for fish bait here. The San Saba is a very clear, beautiful stream, full of fine bass and a great variety of other fish.

If we could only start an academy of science down here in Texas, and set people with scientific proclivities at work, we might make the most valuable contributions to our scientific knowledge. Texas needs a scientific survey of the State more than anything else.

JOHN D. PARKER.

FORT MCKAVETT, TEXAS, May 2, 1883.

LETTER FROM CHIHUAHUA.

CHIHUAHUA, MEXICO, May 21, 1883.

EDITOR KANSAS CITY REVIEW OF SCIENCE AND INDUSTRY:

Within the recollection of men much younger than the writer the journey from Kansas City to Chihuahua, 1400 miles, was made only with ox-teams laden with merchandise, and occupied full four months of wearisome and dangerous toil and exposure. Now the same trip can be made almost over the same trail, in the luxurious palace-cars of the Atchison, Topeka & Santa Fe Railroad Company in less than three days, while the inner man can be regaled with viands

unequaled in quality, quantity and variety at its elegant eating stations all the way through.

Starting on May 9th with the Kansas Press Association, a body of about 160 intelligent, vivacious and companionable gentlemen and ladies, under the management of the courteous and vigilant veteran F. P. Baker, of the Topeka *Commonwealth*, we rapidly passed across the well-known rich and thickly settled counties of Johnson, Douglas and Shawnee, thence southwestwardly from Topeka through the coal-fields and pasture-lands of Osage County into Lyon County, one of the oldest and most productive in the State, where we strike the Neosho Valley at Emporia, a handsome and metropolitan kind of city. Speeding along westwardly over a lovely and fertile country well built up with towns and farms, we reach Newton at breakfast time, where we turn almost directly south to the place of the Press meeting, Winfield, Cowley County. The country from Newton to Winfield is surpassingly rich and attractive, so much so that it is one of the most thickly settled regions in Kansas. After the regular exercises of the session, consisting of addresses, election of officers and a social reception by the citizens of Winfield, we commenced the excursion.

The first point of interest visited, was Garden City in Sequoyah County, near the extreme western border of the State of Kansas. Here the soil is very fertile, but the rainfall is unreliable and insufficient for agricultural purposes; hence an extensive and successful system of irrigating the fields has been adopted, from which very gratifying results have followed. The members of the Press Association were taken in carriages and other vehicles some two or three miles up the Arkansas River to the head of the canal, where the whole plan was explained. The process of course simply depends upon securing a sufficient head of water to overflow the lands below and then leading it by small ditches and furrows through the fields and over the growing crops.

The best crops are wheat, oats, rye, barley, potatoes, sweet potatoes, onions and vegetables of all kinds, millet, broom corn, sorghum, Alfalfa clover, and, in fact, all crops are produced in this latitude.

The following table will show the amount produced per acre and prices obtained for the same, in 1882:

PRODUCTIONS.	BUSHELS PER ACRE.	WEIGHT PER BUSHEL.	PRICE REC'D.
Barley	50	52	$ 75
Corn	30	60	90
Oats	75	45	75
Potatoes	300	60	2 00
Sweet Potatoes	500	55	2 25
Onions	750	57	2 25
Turnips	1,000	50	50
Artichokes	400	56	1 00
Alfalfa Clover. . . . tons	12	. .	8 00
Millet . . . . . tons	5	. .	5 00
Sorghum . . . . . tons	200	. .	3 00

And other crops in proportion.

Fruit trees and small fruits grow to satisfaction, and yield abundant fruit of superior quality. Corn does moderately well, and will be a successful crop as the country grows older.

The planting season is from March 1st to July 1st.

There are four main canals now opened, (May 10, 1883), embracing an area of 300,000 acres of land that can be flooded.

Size of canals, from ten to forty feet wide, and from one to four feet deep.

After enjoying the hospitalities of the citizens for a few hours our train pushed onwards towards the west and night fell upon us in the solitudes of the Raton Mountains. We reached Las Vegas the next morning, where we spent the forenoon in examining the queer and quaint civilization of the descendants of the Aztecs, now becoming rapidly overshadowed by the modern ways of the "Gringos." Street cars, gas, water works, and telephones, may be seen side by side with the burro, the adobe hut, the primitive ox-cart without a nail or other iron part in its construction, and the large out-of-doors earth-built oven; but it has little effect upon the true Mexican. He looks on calmly, shrugs his shoulders compassionately as he witnesses this reckless haste, and as he wraps himself in his blanket for a siesta, mutters his favorite expression "mucho tiempo" (plenty of time). The business of Las Vegas is growing rapidly and it has assumed within the last two years an air of solidity which it did not have when we saw it last. A branch of A., T. & S. F. R. R. takes passengers to the celebrated Hot Springs, about four miles out, where is to be found the largest and finest hotel west of St. Louis, known as the "Montezuma." At this hostelry we were royally feasted and feted, bathed and irrigated with hot water to our heart's content, and our body's renovation. The medicinal qualities of the springs, of which there are about fifteen or twenty within a compass of a few acres, attract many invalids from all parts of the country.

An analysis made by Professor Lovewell, of Washburne College, Topeka, gives the following results:

The quantity of Magnesium Carbonate in most of these waters is very small, with indications of a small quantity of Potassium and traces of Lithium. Carbonic Acid is probably in the bubbles arising from most of these springs.

Santa Fe was our next stopping place. There we again found the ancient civilization giving way to the new, though sufficient of the former still remains, and will remain for many years, to make the city an object of interest to the tourist. Ancient churches, old Government buildings and old ruinous adobes of all sizes and shapes vie with the Palace Hotel, the Windsor, the new cathedral, the University of New Mexico and the Railroad Depot.

One of the principal objects of interest is the Palace. Some irreverent tourist says it has more the appearance of a rope factory than of a palace. It is said to have been first built in 1581 by the Indians, from material taken from an Indian pueblo; it is one story high, with a porch in front, and occupies one side of the plaza, or public square. Some of the walls are five feet thick. It had been the

palace of the Pueblos before the holy name of Santa Fe had been given in baptisemal blood by the Spanish conquerors; palace of the Mexicans after they broke away from the crown of Spain; palace during its occupation by El Gringo; the

No. of Springs.	Temperatures, Fahrenheit.	Parts of Solid Constituents Contained in 100.000 Parts of Water.					
		Sodium Chloride.	Sodium Sulphate.	Sodium Carbonate.	Calcium Carbonate.	Silicic Acid.	Tot l Solid Residue.
2	105.5	27.36	16.82	5.02	4.03	9.97	65.53
3	120	27.38	15.72	3.04	2.01	4.41	54.06
4	92	23.41	14.62	2.55	4.02	7.20	58.33
5	103	28 54	16 96	2 10	3.03	8.88	57.90
6	122	27 86	16.86	3.39	2.00	6.03	56.20
6½	123	28.02	17.98	1.24	1 05	6.60	55.63
7	71	28.63	17.86	2.01	3.02	6.03	5.80
8 and 9	114	27.86	10 80	1.54	2.01	?	54.60
10	117	27.70	15.12	3.20	2.05	5.45	56.40
11, with 10 and 12	124	26.04	17.86	1.52	1.18	6.10	54 83
12	112	26.03	15.70	3.14	5.26	6.80	56 46
13	136	28.03	17.72	1.50	3 01	6.16	57.00
14	92	28.85	18.00	1.03	1.24	6.93	55.40
15	82	27.36	18 64	1 00	1,16	?	55.90
16	112.5	27.36	19.86	2.01	1.05	7.26	57.73
17	112.5	27 86	17.22	.98	1.06	5 33	53.00
18	96	26.63	17.54	1.08	1.00	?	56 16
19*	. . .	. . .	. . .	. . .	. . .	. . .	. . .
22 with 20	106	26.87	11.54	1.23	1.55	6.20	54.56
21	86	28.19	14 10	1.16	1.10	?	56.95
22	75?	27.36	17.32	1.15	1.08	6.63	57.00
23	123	28.19	12.50	2.33	3.01	6.20	60.20
Cold Sulphur†	. . .	33 01	18.14	11.20	38.52	1.20	102.06

* Spring overflowed at time of collecting water. † Sulphuretted hydrogen gas.

palace of the territorial governor, Gen. Lew. Wallace while he wrote "The Fair God" and "Ben Hur;" and now the palace of Gov. Lionel A. Sheldon. In the stormy scenes of the 17th century it withstood several sieges, was repeatedly lost and won as the white man or red held the victory. Who can say how many have been the dark crimes hidden within its walls? In it lived and ruled the Spanish captain-general, who was in name a general but in effect a king. Here met all the departmental and legislative bodies that have ever assembled in the capital of New Mexico. Here have been planned all the wars and defenses against invasion that have ever occurred in the Territory. Within its walls were imprisoned many important personages, who, without trial or examination, were led out and shot, by the dictum of the man of the "palace." The history of the palace is the history of Santa Fe. There are so many points of interest in and around Santa Fe that only a few can be mentioned here. On the bank of the Santa Fe River, a small stream which flows past the city, stands the oldest house in America, erected in 1542. San Miguel Church, the oldest church in the United States, is still used; it was built in 1680 and rebuilt in 1710. The

Archbishop's garden is beautifully laid out with walks, fountains, arbors, ponds stocked with fish and trees bearing nearly every variety of delicious fruit. Old Ft. Marcy, on a hill in the northeastern part of the city, erected in 1846 by Gen. Kearney, was the site of the encampment of De Vargas in 1693. Many other places of as much interest might be mentioned. Right over the old San Francisco chapel, as it stands, are being reared the massive stone walls of a cathedral, to cost $150,000. It is modern in style. Santa Fe is showing signs of contact with the outside world, not only in the enterprise of her business men but the architecture of churches, hotels, etc. The climate of Santa Fe is delightful, its elevation of 7044 feet counter-balancing its southern latitude. The soil in the vallies is good and produces enormously under irrigation. The Cerillos gold, silver and coal mines are adjacent. These mines produce largely of an excellent quality of anthracite.

Passing along, we strike the Rio Grand River at Wallace, an eating station of the A., T. & S. F. R. R. and a mining centre. Here the Indians, clad in blankets and vermillion, silently offer turquoises, opals, and other mineral specimens to the travelers at "two bits" each. Morning found us at El Paso, Texas, a busy, thriving American town of 3,500 inhabitants, with a visible admixture of Spanish and Indian citizens. It is in the midst of a vast sandy plain, but being the terminus of five railroads it has fine promise of future commercial greatness.

Immediately across the Rio Grande is the old city of El Paso Del Norte, in the State of Chihuahua, Old Mexico. This "Gateway of Mexico," though brought into prominence by its railway connections, is still the typical Mexican village. The quiet streets present rows of low adobe houses, the windows guarded by lattice or iron bars; on the plaza stands a church said to be 270 years old. The general offices of the northern division of the Mexican Central R. R. are located here, also a custom house and small military garrison; a weekly paper is published in the Spanish language, and short terms of the State court are held at stated intervals. The town runs down the river several miles, and the adjacent valley is thickly settled. There are a number of vineyards in a high state of cultivation, and under proper management wine-making might become a very profitable branch of industry, for the soil is especially adapted to the cultivation of the grape.

There are no towns worthy of mention between Paso del Norte and Chihuahua. For thirty miles south of Paso del Norte the road runs over a vast sandy plain with a scanty growth of mesquite, thorn bushes and cactus. From Samalayuca some characteristic views can be obtained. On both sides of the road bold, isolated peaks rise from the plain to altitudes varying from 2,000 to 3,000 feet. These detached mountains form a peculiar feature of the landscape. At Candelaria, forty-seven miles from Paso del Norte, the Candelaria range comes into full view. At San Jose, seventy miles from the Rio Grande, the appearance of the country changes and vast grazing ranges stretch away from the track on both sides; the Rio del Carmen furnishes water for irrigation, and farming is made very profitable. Here a new feature of the landscape makes its appear-

ance; to the southwest as far as the eye can reach, heavy timber fringes the banks of the Carmen. From this point on to Chihuahua there is no marked change in the landscape; the country over which the track passes appears as if it had once been the bed of a series of lakes, and the soil is very fertile. The soil is a peculiar chocolate colored loam. Everywhere immense herds of cattle are seen, and herds of deer are frequent.

Chihuahua is the Capital of the State of the same name and its principal town, situated 4,640 feet above the level of the sea, in 28° 38′ N. Lat., and 10° 30′ W. Long. from Greenwich, and containing a population at the present time of about 16,000. It was settled toward the close of the 17th century by some adventurers for the purpose of working the rich silver mines discovered about that time in its vicinity. Among these the most prominent mine was the "Santa Eulalia." When this mine was in its most prosperous state the city contained more than 170,000 inhabitants. But the general expulsion of the Spaniards, and the revolutions which followed, caused the partial abandonment of the mine and a great decrease in the population of the city.

Chihuahua, as approached by the railroad, presents a picturesque appearance To the south are the conical hills in bold relief against the clear blue sky; to the east and west are short ranges of mountains, while the city itself, surrounded by massive cottonwoods, with its towers and domes and peculiar adobe architecture makes quite an oriental picture. The city of Chihuahua was founded in 1604 and is the Capital of the State of Chihuahua. It is 225 miles from El Paso. It lies on the bank of the Conchos River, a stream of pure, clear water that winds around the foot of a picturesque range of mountains just below the 29th parallel of N. Lat., and has an altitude of 4,600 feet. The city is laid off regularly, with paved streets and sidewalks which are kept clean by being swept every few mornings and the dust carried away. Nearly all the houses are of adobe—although the public buildings and some of the dwellings are of stone—and one story high, and are built in the usual Mexican style, around a square or court called a "placita." The city is supplied with water from the river Churiscar, ten miles distant, by means of an aqueduct built by the Spanish between 1717 and 1720. It is built of stone and cement, a large part being built upon great arches of masonry, and is in a perfect state of preservation.

The chief attractions are the celebrated cathedral, the mint, and the square called "Plaza Major." The cathedral is situated on the west side of the plaza and is a beautiful and imposing brown-stone structure. It was commenced in the year 1738 and finished in 1849, costing about $750,000. It is a fine specimen of architectural skill, is surmounted with a dome and two towers, and is in the Moorish style of architecture. A clock illuminated at night ornaments its dome, and its facade is embellished with life-sized statues of the Saviour and Twelve Apostles. In one of its towers is a bell which was pierced by a cannon-ball at the time of Maximilian's invasion in 1866, and in which the renowned patriot Hidalgo was at one time confined and afterward executed. The plaza is a beautiful place occupying the space of a block; it is paved and contains an elegant

fountain thirty feet high. The plaza is laid out in walks lined with orange trees and beautiful flowers. Every evening the walks are filled with promenaders and an excellent band discourses sweet strains of Spanish music for their entertainment.

The population of the city is officially stated at 18,000. The present mayor of Chihuahua is Don Juan Zubrian, a gentleman of broad views, well educated, refined, and courteous. He takes pleasure in giving information to Americans, and under his rule the city is as orderly as any of the same size anywhere. He gave our party a very cordial reception and expressed himself anxious to cultivate closer commercial relations with the people of the United States.

The silver, gold, and copper mines of the State of Chihuahua have in former years been very productive, and even in 1844, the mint of Chihuahua, struck $61,632 in gold, and $290,000 in silver. In the year 1814, the coinage of this same mint amounted to $1,818,604 in silver and nearly $16,000 in gold. However, since the last named period the coinage has fallen off considerably on the account of the lack of energy of the mine owners in the operation of their properties. If work now in progress on these various mines continues the output must inevitably far exceed that of all previous years.

The most thoroughly developed and best copper mines at present known are those of Santa Rita, near the union of the Rio Felonida with the Rio Conchas. Veins of iron, cinnabar, lead, sulphur, coal and nitre have been discovered and explored, but never fully opened out. The chief mining districts and mineral deposits are those of San Bartolome, San Barbara, Chihuahua, Cosehuiriachi, Santa Eulalia, Jesus Maria, Loreto, Moris, Mulatos, Minas Nuevras, Parral, San Pedro, El Refugio, Santa Rita, Sierra Rica, Batopilas, Urique Y Ximenes, or as it is called Guajuguilla and Morales.

One of the most noted mines of Chihuahua is the Santa Eulalia, five leagues from the Capital. So rich was this mine that the cathedral, costing nearly $800,000, was built from a fund raised by a tax of one "real" (12½ cents) on every "mark" of silver ($8.00) obtained from it. The fund was collected during a period of seventy-two years, commencing in the year 1717 and terminated in 1789.

It was worked as early as 1705. Its registered product from that time to 1737 was $55,957,750, or an average yield of $1,748,742 per annum. From 1737 to 1781 it yielded something more than forty-four million of dollars, making a total of one hundred millions of dollars during a period of eighty-six years.

The district was gradually abandoned during the latter part of the last century on account of the invasions of savage tribes, but in 1791 it possessed a population of 6,000 inhabitants with seventy-three Haciendas for reducing metals and one hundred and three smelting furnaces; all these have gone to ruin and the product from 1791 to the present time is less than twenty millions of dollars, but the probabilities of restoring the mines to what they were is in the opinion of those who are competent to judge, undoubted.

The mine is now owned by a stock company, whose principal owners reside

in Boston. The property consists of four square leagues or three miles square of surplus grants, which is one of the largest concessions ever granted by the Republic of Mexico. They have every indication favorable of a great deposit of silver ore underlying the whole property.

In the northwestern part of the State of Chihuahua are found many interesting remains of antiquity. These remains are to be found lying near the village and Casas Grandes River. Between Janos and Galeana ruins of large houses known as the "Casas Grandes" in the language of the country, exist in the neighborhood, built of adobes and square timber. They are two and three stories high with a gallery of wood and stairway from the exterior. They have very small rooms and narrow doors in the upper stories, but are without means of entrance in the lower. A great watch tower, commanding an extensive prospect, stands on an elevation two leagues southwest of it. A series of mounds, containing earthen vessels, weapons, instruments of stone, and fragments of white, blue and violet-colored pottery, extend along the banks of the Casas Grandes and Janos Rivers. C.

[*To be Continued*]

ARCHÆOLOGY.

AN ARCHÆOLOGICAL FIND.

J. L. R. WADSWORTH.

COLLINSVILLE, ILL., April 28th.—An interesting and valuable archæological find was made this week on the farm of Hon. J. R. Miller, two miles southwest of this place, on the bluffs bordering the east side of the American Valley, by Mr. McAdams, Assistant State Geologist. At this place there is a group of mounds situated on the summit of the bluff, and overlooking the valley below. In this vicinity parts of human skeletons have been plowed up, and Mr. McAdam selected this site for his excavations. After digging down but a few inches he discovered the first indications of relics, and in all nineteen human skeletons, a large number of specimens of pottery, copper and stone ornaments and domestic and agricultural implements. The skeletons found were both male and female, also both adults and children. They were arranged without system, as to direction of the compass, and were found lying one over another in layers. The upper layers were best preserved and regular, while the lower layers were disturbed, as if in digging the upper layers had been separated and detached from their original places. The relics were all found from ten to twenty-four inches under the surface, although, no doubt, they had been buried much deeper, but the soil had

washed away. These skeletons were many of them in an excellent state of preservation, while others were partially disintegrated.

Some gave indications of having been partially burned. The skulls varied much in formation. Some were endowed with very prominent projection of the lower bones of the face; others comparing very favorably as to size and development with the present generation. The writer found one specimen of bad surgery that was quite interesting, and we have placed it among the archives, it being an anchylosed elbow joint. During life there had been a fracture, with dislocation of that joint, and the bones had consolidated. We noticed the surgeon (?) left the arm extended. Near the central portion of the group the remains of a splendidly developed man were found; his skull was unusually large and would indicate a large brain development. From the marked attention "the prehistorics" had paid to his burial, he must have been a prominent man, for near his head was found a large proportion of the pottery. Resting against each side of his skull, so as to discolor it, were copper and bone rings, that had probably been attached to his ears. It is difficult to describe them, for they were quite intricate. The bone, however, seemed to be overlaid in part with copper. A large number of shell ornaments of ornate form much elongated, with one or two perforations in the end, as if to run them on a string, also bone beads of various shapes. These seemed to be associated more with the remains of the children.

We noticed a few specimens made of shell—the external portions of which had been removed—perforated with small holes like a strainer, and they certainly would answer quite well for this purpose, as the shells were large, some six inches in diameter. The shells that were still in their natural state, of which there were several, were much larger than would be found in this region, and belonged to the miacidea or clam family. The pottery was by far the most interesting from an artistic point of view. A sculptured frog, six by ten inches, was perhaps the most prominent, and gave evidence of skill of no mean order. Mr. McAdams thought he was no common frog, for he held something in his right hand, possibly associating him with religious customs of those days. He was well formed, and a bowl-shaped opening was placed in his back, with a small opening from the bottom of the bowl, extending at right angles backward, and came out at the tail, as if it were a huge pipe, with the opening for the stem at the tail. There were several bowls of nearly as great capacity; one, in particular, that had sculptured lizards for the handles. These were quite perfect and the effect was fine. The lizard was in the act of surmounting the rim of the bowl, and his head peeping over the edge, as if inspecting its contents. Several bottles of the old Egyptian style, a flattened sphere for the body and a long slim neck, were also found. They were very skillfully made, and were not much thicker than glass, and well burned. Several needles of bone, similar to the modern crochet-needle, also one long copper needle, were found. We omitted to mention some little three-legged pots, holding about a gill, that had some sculptured designs on the sides.

Mr. McAdams showed us the first specimens of flint hoes that we ever saw. These he had just secured from some people living in the neighborhood. One

was about seven or eight inches in diameter; another ten or twelve inches long, and four broad. Both gave evidence of considerable use, as the cutting edges were finely polished. We have no doubt that if the proper search and investigations were made, a large and more valuable collection of relics could be obtained in this region that would be of great interest to the archæologist, and do much toward filling the blank as to the history of the former inhabitants of this country.

—*Cor. Globe-Democrat.*

KANSAS CITY FOSSILS.

The Upper Coal Measures of Kansas City and vicinity have proved a rich field for the collector of its characteristic fossils. For variety, size and general perfection, these fossils will compare with those of any other locality in the same formation. Many of them are evidently new and have never been described. This is especially the case in regard to the Cephalapoda (Nautili, Goniatites, Orthocerates) of which there are a great variety, some of new and rare forms. Some of the collectors of this city have exerted themselves to make good local collections, and there is nowhere a wealth of material waiting to be worked up by some good palæontologist. As we have not got the books of reference and specimens for comparison, to make a study of these fossils ourselves, we are anxious to place our treasures at the disposal of some one who has the ability, time and facilities to make a complete monograph of them, believing that it will not only be of value to us but to the interest of science in general. The writer has in preparation a list of the fossils of this locality, so far as we have been able to identify them with our limited sources of reference and comparison, to be published in some future number of the REVIEW. It will necessarily be incomplete and somewhat imperfect, but we hope it will lead to a more complete and perfect list, and also show the abundance and variety of our material.

Mr. A. C. Austin, of this city, has just acquired a very fine fossil from the coal mines at Williamsburgh, Franklin County, Kansas. It is a lower jaw, twelve or thirteen inches in length, embedded in the upper surface of a block of coal, the teeth in place and well preserved. From the structure of the teeth it evidently belongs to a class of large Batrachians found in the coal measures of Ohio and other States, some specimens of which are figured and described in Vol. II, Geological Survey of Ohio, 1875, but rarely found west of the Mississippi. The owner would like very much to have it identified and named, and would be pleased to have any one familiar with this class of fossils call and examine it at his residence, southeast corner 8th and Oak Sts., Kansas City, Mo.

W. H. R. L.

GEOGRAPHY.

CALIFORNIA ON THE OLD MAPS.

E. L. BERTHOUD.

In the course of investigations relating to the early history of Louisiana, New Mexico and California, under French and Spanish rule, and also as to the earliest discoveries of the west coast of America, begun by the renowned conqueror Cortez, who strove like many others in that century to wrest the secret of that short passage into the South Seas and far Cathay which would open the wealth of India to them, we have been puzzled to account for the fact that beginning in the latter half of the 17th century and until the middle of the 18th century California was almost invariably represented as an island, while as early as 1546, the presumable date of Sebastian Cabot's map of the world, until into the 17th century, this Peninsula was invariably shown as connected with the main land. Cortez himself first explored the Gulf of California, which was known afterward as the "Mar de Cortez." Following this expedition he sent Francisco de Ulloa to explore this sea. Ulloa reached its north end, explored there a large river, ascertained the continuity of land on both sides of the Gulf; sailed out of the Gulf and explored the west coast of Lower California to the 28th N. Lat. Alarçon afterward under orders from Mendoza, Viceroy of Mexico, explored the same Gulf and ascended the Great Colorado over 200 miles, and, like Ulloa, he found that the land was continuous. Now, how did the change from peninsula to island occur, in both cartography and in geography?

We will analyze some of the earlier maps, and also those as late as in the middle of the last century giving still the erroneous idea of the insular character of California. 1st. The map of Sebastian Cabot, chief pilot of Spain, of date of 1540–46. This shows California as a peninsula extending on the Pacific coast to 32° N. Lat. at Cabo de Lengaguo, while on the east coast of Lower California the sea extends to about 34° N. Lat. where two large streams enter the Gulf of California, the one on the west called Maha-beyo, while the eastern river is called Damates. The gulf between the two is called Ancon Chay de San Andres; on the map we here find a legend as follows: "Esta tierra fué descuhierata por El Marques ad Valle de Guaxa Don Hernando Cortez." Which translated means that "The country was discovered for the Marquis of the Valley of Oaxaca, Don Hernando Cortez." Ulloa was probably the explorer who made the survey.

2d. The map of J. M. Patavino, Bologna, A. D. 1597. This also represents California as a peninsula, much wider from the Pacific to the Gulf than in

Cabot's map. Two rivers are also shown as discharging themselves at the head of the Gulf, which is called "Mar Vermejo," i. e. Red Sea. The south extremity of this peninsula is named Cabo California. For that period this map of North America is very complete.

3d. Du Val's map, dated Paris, 1682. This map represents all New Mexico and California, with a small portion of "Canada, or Nouvelle France" extending to the 263d Par. of E. Longitude; very near the present boundary between New Mexico and Arizona, an unheard of pretension. California is here represented as a island extending fully to the 46th N. Lat. Cape Mendocino in 42° Lat., while the "Port de Sir François Drac" (Sir Francis Drake) is an indentation in about 40° N. Lat. The Colorado is called Teçon River (Rio del Tison Sp.) a river of firebrands, with a branch marked Rio Xila—the Gila River. The whole sea between the California Island and North America is called "New Vermuille" or Red Sea. The main land of America between 40° and 44°, he calls Quivira or New Albion. The map of Du Val is inferior in accuracy to that of Patavino or Sebastian Cabot. Du Val seems to have tried to improve on the maritime map of Johannes Janssonius of early in the 17th century, who claimed Spanish authority for his innovation of making California appear as an island on his map.

4th. Is a map of North America appended to an edition of Dampier's voyages, Amsterdam, 1712. It differs but little from Du Val's map; does not, however, locate Canada in New France; shows New Mexico extending to the Mississippi River, while Florida is shown as extending to the Ohio River. California is a long wide island extending nearly to 49° Lat., where now are the Straits of Fuça.

5th. This is a copy of the Map of Father Eurebe F. Kino, Paris, 1724–25, from explorations made by him from 1698 to 1701. Map is from Lettres édificantes, etc., of the Jesuit Fathers.

This map well represents the Gulf of California, and all Lower California, and its true connection with the continent of North America. The Colorado is shown for about 300 miles, which is, however, shown as trending too far east. The Rio Gila is also shown to a point many miles east of the Casas Grandes; while all over the map, and extending to Cinaloa, many small towns and missions are distinctly shown.

Father Kino made an overland journey to the missions on the Great Colorado, and his explorations then settled beyond doubt, that California *was not* an island as heretofore supposed, or believed. Yet, in spite of this evidence, we find in maps as late the middle of last century that it was still supposed to be, and was yet called an island(?).

The 6th map examined bears date of London, 1757, purporting to be a map of North America appended to an edition of Sheleveke's Voyage. This map represents Florida as extending to the Del Norte River, and north to the great lakes, while California, a vast island, extends to nearly 48° N. Lat. Opposite to its north end, but far inland, is an attempt to show the great Salt Lake, or Lake Impanogus of the Spaniards.

We have given this critique of the six maps examined, and the reader will naturally ask what then? what has all this proved or developed?

We have, we think, shown that the earliest explorations of the Pacific northwest coast, and of the Gulf of California, from 1533 until the middle of the 17th century or thereabout, proved that California was a large peninsula. That later in the 17th century it was then known and described first, we believe, by Janssen, a Hollander, *as an island*, and that by the middle of the 18th century it was again proved to be a peninsula.

Within a third of a century surveys and explorations in California have proved beyond doubt that extending west of the Great Colorado from near Fort Yuma, a vast depression exists below the level of the Pacific Ocean. That east of the San Bernardino Range and running southeast is a vast arid basin, treeless and almost waterless, sixty feet or more below sea level, with the present existing bed of a stream at its lower end leading to the Colorado and called "New River." This depressed area shows marks of the comparatively recent presence of water, and has been once completely submerged. Our theory is that since the early exploration of Ulloa and Alarçon, or even much later in time, this area of depressed land has been occupied by water, and that in Cabot's map the Maha-beyo is the present New River, now nearly dry. That Spanish explorations in the 17th century found this depressed area then covered with water, although land stretched westward from the Great Colorado to the then inland lake; that this lake had been formed by the overflow of the Great Colorado, which afterward became dry, its former communication with that stream being destroyed; a probable movement of elevation taking place, a few years exposure to the dry winds and intense heat of that region soon evaporating the overflowed area, and sufficing to render it what it really is, the dry bed of an evaporated fresh-water lake, in which a few estuary shells may have at one time of unusual height, crept up from the Gulf, when following the brackish waters mingling at the mouth of the Great Colorado.

We certainly believe this was the origin of Janssen's Spanish Account, while the latitudes given on Cabot's map certainly place the head of the Gulf much farther north than in more recent maps. New River is also shown in Patavino's map. Nor is it unreasonable to believe that three and a half centuries since the Gulf extended to near the present Ft. Yuma.

The *American Naturalist* for June, 1883, and *Science* for May 25th, present their readers with abstracts of Dr. Edwin R. Heath's article in the April number of the Kansas City REVIEW upon "Dialects of Bolivian Indians," as an important and valuable contribution to geographical and ethnological literature.

ENGINEERING AND MINING.

THE ATCHAFALAYA OUTLET.

There is a great deal being said about the danger of the Mississippi River seeking a new outlet to the Gulf, by way of the Atchafalaya Bayou, and the people of New Orleans are justly anxious over the possibility of their city becoming an inland town, with mouldy wharves and grass-grown streets.

The Red River flows into the Mississippi at a point about 210 miles above New Orleans. From the former just before it reaches the Mississippi, the Atchafalaya starts out and flows through swampy forests in a direct course to the Gulf of Mexico. Its length is 160 miles and it is 327 miles from the mouth of the Red River to that of the Mississippi.

The Atchafalaya was formerly a sluggish stream, hardly worthy the name of river, with a depth at its beginning of only two or three feet. Cows grazed on the reeds in its bed, huge rafts of fallen timber clogged its course and unexplored forests bordered its banks. This was the condition forty years ago but since that time there has been a wonderful change. It is now a mighty river with a depth of more than 125 feet and its swift torrent rushes and whirls among the old trees, sweeping them away in its resistless course.

In the current number of *Harper's Weekly* is given a sketch of this stream which has become so important. The Government engineers were divided in opinion as to the best course to be pursued in regard to it. Capt. Eads advised the closing of the stream by a dam, and, when a majority of the board disagreed with him, he resigned his place. There is danger both in closing this outlet and in leaving it alone. In the former case the Lower Mississippi country is liable to be overwhelmed with an excess of water, while in the latter event it is likely that the Atchafalaya will become the main channel of the Mississippi.

If the present channel should be changed there would be vast benefits and injuries. The latter would be inflicted upon the New Orleans and the costly jetties would become useless. The city, as is well known, is 116 miles from the mouth of the river and ships have to come up this distance. The current below Natchez is sluggish and winding. But if the Atchafalaya becomes the main channel there will be a swift deep current flowing straight out into the Gulf and Atchafalaya Bay will become the great harbor of that coast. Morgan City in such case would become a rival of Galveston and a larger town than Mobile or New Orleans.

It is questionable whether or not it is possible now to check the threatened calamity, for the water in both rivers is very high and it is a difficult matter to dam a stream which is over 125 feet deep and whose current is exceptionally

rapid. If New Orleans should become an inland town, and the course of the Mississippi be changed, we believe it would be better for St. Louis and the whole of this great valley.—*St. Louis Railway Register.*

THE LAW AS AFFECTING MINING AND METALLURGICAL INTERESTS.

(*Recent Rulings of the Commissioner.*)

By a recent ruling, the claimants of mill-sites are permitted to cut and remove timber thereon for the purpose of constructing mills, reduction-works, tramways, or other accessory required in developing their mining interests. In permitting the removal of timber from a mill-site or tract of non-mineral land, prior to the issuance of a patent therefor, it is strictly forbidden to make such timber an article of sale for private gain or speculation.

The law recognizes two ways by which title to a placer claim may be shown one by a duly certified abstract; and the other, under the statute of limitations.

A final certificate received at the General Land Office is made out to John Doe *et al.* The commissioner advises the local offices that *et al.* is altogether too loose and indefinite a basis upon which to issue a mineral patent.

A local attorney asked the commissioner to dismiss an application for patent because no appearance had been entered here on behalf of the party. The commissioner says: Should the motion come properly before me for consideration, I require advice as to the rule which makes a failure to employ resident counsel sufficient ground for dismissing an appeal without considering the merits of a case.

Concerning the right to order a hearing, the commissioner considers it proper in the exercise of his discretion to order a hearing upon whatever question of fact arising in a case and at whatever stage of the proceedings he pleases. When entry is made of a mining claim and the money paid for the land, the receiver of the local land office in which the claim is entered fills out two receipts for the amount paid: one of these is transmitted with the final certificate of entry and the papers and the application for patent to the General Land Office. The other receipt is given to the purchaser. When patent is issued, it is delivered to the party holding the duplicate receipt, who surrenders the same. An attorney for the owner or any one else holding the duplicate receipt can obtain possession of the patent. Usually this receipt is held by the attorney attending to the business of the claimant.

Application for patent and publication of notice thereof, as required by law, do not exempt a lode claimant from making the annual expenditures thereafter upon his claim. That requirement ceases only after payment of the purchase-money and entry in the local land office.

"A" filed an application, and due publication was made. He failed to prosecute his claim, and the case rested, when "B" appeared at the local office

and made a motion to dismiss the proceedings, in order to make application for patent, basing such motion upon a certificate of subsequent relocation and a decree of court in an action commenced by "B" against "A" to quiet title, which decree was rendered through the default in appearance of "A." The Commissioner of the General Land Office refused to dismiss "A's" application upon such a showing, holding that the courts had no jurisdiction at that stage of the proceedings; that the question of abandonment after the period of publication prescribed by law is one which must be determined by the Executive Department after an investigation. "B" appealed from this ruling to the secretary, who ordered a hearing to determine the question of abandonment before relocation.

The question of a disputed mining title is always one for judicial investigation, and can in no instance be determined by the General Land Office.

Application for patent cannot be received at a local land office for a lode claim embracing a portion of the surface ground of a claim for which an application has been previously filed and is still pending; but when an application has been properly refused a filing, the subsequent application for a patent for another lode should be received, although including part of the surface claimed adversely by others.

Where non-mineral lands have been fraudulently entered under the mining laws, disinterested parties may, at any time before patent issue, lay the facts before the General Land-Office, supported by affidavits of reliable persons; and, if sufficient to establish a *prima facie* case of fraud or illegality, a hearing will be directed to be held by the local land-offices for the purpose of determining the truth of the charges made, and, if substantiated, the entry will be canceled.

The rule which forbids the reception of an application for patent to a mining claim which conflicts with a claim embracing a prior pending application is derived from that provision of the statute which prescribes the method of filing adverse claims. Where the statute prescribes one way in which a thing shall be done, it precludes every other. It is easy to see that this rule is a salutary one; for were it otherwise, application after application might be accumulated in the local office, all relating to the same land, thus nullifying the law which requires adverse claims to be filed and prosecuted. A suit upon an adverse claim, commenced after the period prescribed by law has expired, does not justify the suspension of proceedings for patent.

Coal lands were never subject to location with Sioux or California University scrip.—*Engineering and Mining Journal.*

Advices from the Cariso mining district, in Western Texas, state that an immense deposit of chloride and horn-silver has been discovered in the neck of country lying between the Pecos and Rio Grande Rivers. The surface croppings of horn-silver are said to be very rich.

METEOROLOGY.

REPORT FROM OBSERVATIONS TAKEN AT CENTRAL STATION, WASHBURN COLLEGE, TOPEKA, KANSAS.

BY PROF. J. T. LOVEWELL, DIRECTOR.

The usual summary by decades is given below.

TEMPERATURE OF THE AIR.	Apr. 20th to 30th.	May 1st to 10th.	May 10th to 20th.	Mean.
MIN. AND MAX. AVERAGES.				
Min	. .	. .	. .	. .
Max	. .	. .	. .	. .
Min. and Max	. .	. .	. .	. .
Range	. .	. .	. .	. .
TRI-DAILY OBSERVATIONS.				
7 a. m.	48.3	58 0	53.2	53.2
2 p. m.	68 0	77.9	64.3	70.1
9 p. m.	54 4	64.1	57.8	58.8
Mean	56.3	65.7	58.3	60.7
RELATIVE HUMIDITY.				
7 a. m.	.92	.91	.92	.92
2 p. m.	.74	.74	.89	.79
9 p. m.	.91	.89	.91	.87
Mean	.86	.85	.91	.86
PRESSURE AS OBSERVED.				
7 a. m.	28.84	28.94	28.88	28.92
2 p. m.	28.84	28.94	28.87	28.92
9 p. m.	28.87	28.84	28.88	28.86
Mean	28.85	28 91	28.88	28.90
MILES PER HOUR OF WIND.				
7 a. m.	13.9	16 8	20.2	. .
2 p. m.	19.9	27.5	26.5	. .
9 p. m.	10.9	17.7	16.5	. .
Total miles.	3489	4763	4405	12657
CLOUDING BY TENTHS.				
7 a. m.	6 3	6 5	5.8	6.2
2 p. m.	5.6	4.5	6.3	5.5
9 p. m.	4.0	5.1	5.1	4.7
RAIN.				
Inches.	0.83	0.25	3.57	4.65

The first two decades of this report were characterized by low temperatures, backward vegetation and high winds. The rains which began May 11th were very heavy, giving a total in this decade of 3.57 inches.

There have been at this station no wind-storms to do any special damage, and the rains came in season to be of great advantage to the wheat crop.

The very low barometer of April 22d is unusual, and has not been so low before at this point in five years—the period of our observations.

Highest temperature, 90°, May 2d. Lowest temperature, 36°, April 1st. Highest barometer, 29.320, May 11th, reduced 30.304. Lowest barometer, 28.190, April 22d, reduced 29.125.

THE KANSAS CITY TORNADO, MAY 13, 1883.

On Sunday, May 13th, at least four different tornadoes originated in eastern Kansas and swept across a greater or less portion of the State of Missouri, viz: one near Troy, in Doniphan County, crossing into Andrew County, Missouri, and extending eastwardly a few miles; a second in Wyandotte County above this city and sweeping across the Missouri River into Clay County, and so on eastwardly along the H. & St. Jo. R.R. as far as Macon City, the third also originating in Wyandotte County and confining its ravages mainly to this city, as described below, and a fourth starting near Columbus, in Cherokee County, and passing directly into Jasper County, Mo., and doing immense damage in that and the adjoining county northeast

That in which we are most interested occurred at about 5 o'clock P. M., and swept across this city from southwest to northeast, destroying nearly two hundred buildings of all kinds and causing a loss of property amounting to nearly $200,000. Its most remarkable and unaccountable feature was the exceedingly slight amount of bodily injury done to our citizens. Scores of dwellings were unroofed—many of them utterly demolished—in an instant, and but two lives were lost and only a very few persons wounded.

Owing to our absence from the city at the time of the occurrence, we cannot give our personal experience or observations, but must be content to narrate those of others, beginning with an extract from the *Daily Journal:*

"The cool weather on Saturday was followed by a heavy fall of rain on Saturday night and Sunday morning. During the early part of Sunday the weather grew rapidly warmer, and the sultry atmosphere and the peculiar movements and appearance of the clouds indicated that vigorous contest of opposing warm and cold currents which always portends a storm of more or less seriousness.

"The writer was an observer of the gradual concentration of the mighty forces of nature from the time the first indications were noticeable in the southwest, west and northwest until the storm broke with such irresistible force over a portion of our city.

"Between 3 and 4 o'clock the appearance of all the western horizon as far as the eye could see from south to north was that of remarkable counter movements of clouds. The upper stratum of clouds moved counter to the lower stratum with an irregular and uncertain movement, as if they were contending for the mastery. About 4 o'clock the darkest point in the storm clouds was in the northward, and from that point at once appeared what John P. Finley, of the United States Signal Corps, calls a tornado, but what our people will be quite willing to call a cyclone. Its appearance was not to be mistaken. A vast

white funnel-shaped cloud seemed to sweep north of the city of Wyandotte, crossed the Missouri River writhing and bounding and carrying with it great clouds of dust, and scooping up vast sheets of water in its course.

"It traveled east and disappeared. In the meantime the contending forces in the west seemed to battle with renewed fury, and a tremendous movement toward the south with indications of a second cyclone, was distinctly seen.

"If this storm took the shape of the first tornado or cyclone it was so enveloped in the clouds and rain that its outlines were not distinctly traced. It only presented peculiar, undefinable colors as it rushed on to the south. Gradually its course turned to the east, and in its progress seemed to throw off its surroundings and assume the funnel-shape, which fact seems to be substantiated by a number of cool, intelligent witnesses. Finally, taking a course almost due east, the storm passed through the bottom and struck the bluff at a draw near Sixteenth Street, and at the residence of Mr. Horton. In this instance the well-known tendency of these storms to follow draws was illustrated.

"From this point the storm veered slightly to the northeast, and with a breadth of about a block zigzagged its destructive course through the entire city.

"Seldom has a tornado condition been presented to a larger congregation of spectators or under more favorable conditions for observation. About 4 o'clock the elements gave indication that the forces from which tornadoes are born, were at work. These conditions are the meeting of two currents of air, one warm, the other cold—the former from the southwest, the latter from the northwest. As the afternoon advanced the southern sky was comparatively clear, the sun shining and the blue expanse obscured by only a few patches of white cloud, while the northern sky was obscured by a heavy mass of black and slowly advancing clouds.

"The line between the two was the meeting point of the two currents, the warm, moist air condensing as it met the cold current, forming the black clouds which advanced, as the cold current moved forward. These opposing currents could be distinctly seen through rifts in the clouds, the upper strata being more dense, of a less dark hue, and with more sharply defined edges. To their meeting was due the hail that fell.

"The barometer fell very rapidly during the half hour preceding the tornado, to 28.43 inches—lower than it has been for ten years, even lower than during the Marshfield tornado a few years ago, the lowest point up to the present since we have kept a barometer. The temperature was only 70°, showing the presence of the cold current, as in ordinary conditions with the barometer at such a low, the temperature would be above 100°—possibly as high as 110°. In this locality twenty-nine inches is a very low barometer, our's marking but twice below that for many years, once during the terrible storm that inundated the coast towns of Texas, the other during the Marshfield tornado referred to. These facts show the remarkable atmospheric conditions conspiring in this vicinity on Sunday."

Upon going over the ground traversed by the tornado, several days after its

passage, examining many of the prostrated and less damaged buildings and questioning many eye witnesses of the phenomenon, the following conclusions were arrived at, viz:

1st. That the aërial disturbance was a veritable tornado with a whirling motion of intense rapidity and a progressive motion from southwest to northeast of about sixty miles an hour.

2d. That those buildings which were in the center of the whirl were twisted and prostrated by the actual force of the whirling motion, while those outside of the whirl, but in the progressive track of the tornado, were destroyed or damaged by the expansion of the air within them, which threw walls, furniture, and even persons, outwardly and upwardly in every instance.

3d. That almost the entire force of the tornado was expended within the city limits, for, as far as we can learn, no harm was done by it either before it struck the city on the southwest or after its disappearance at the northeast corner; that is to say, it was only about three miles long, while its width in no case exceeded six hundred feet, or two blocks, and in the greater part of its course it was hardly half so wide.

The temperature and barometrical pressure at the various Signal Office stations on this line, for the 12th, 13th and 14th of May, including the day of the storm and one immediately before and after it, were as follows:

MAY 12, 1883, 2 P. M.	BAR.	THER.	WIND.
Ft. Concho, Texas	29.90	87°	S.
Dodge City, Kas.	29.87	77	E.
Leavenworth, Kas	30.12	54	E.
Kansas City, Mo	30.09	60	S.
Keokuk, Iowa.	30.17	56	NE.
MAY 13th, 2 P. M.			
Ft. Concho, Texas	29 76	84°	S.
Dodge City, Kas.	29.41	75	NW.
Leavenworth, Kas	29.22	64	SE.
Kansas City, Mo.	28.80	61	SW.
Keokuk, Iowa	29.78	51	SE.
MAY 14th, 2 P. M.			
Ft. Concho, Texas	30.05	76°	NE.
Dodge City, Kas.	29.85	67	N.
Leavenworth, Kas	29.77	57	NW.
Kansas City, Mo.	29.76	67	S.
Keokuk, Iowa.	29.57	62	W.

It will be observed that the barometer was lower on the 13th than on the day before, or the day after, all along this northeasterly line, but in no other respect does there seem to be any special concurrence of phenomena.

There is a very uniform concurrence in regard to the funnel-shape of the tornado-cloud, though several persons testify to a different shape, a bar or beam-

shape—something like the masses or blocks of light often seen in auroral displays. Several are positive that they saw an electrical light in the small end of the funnel, others declare that when the cloud rose from the West Kansas bottom and struck the bluff near 16th and Holly Streets, balls of electricity were thrown out freely, while the telephone and telegraph operators state that there was no indication given by the wires of any unusual amount of electricity in the air.

One observer who lives on a hill commanding a full view of the eastern half of the track of the tornado, states that the funnel shaped cloud swung or vibrated in the air like a balloon, and that when its apex touched the ground destruction followed. Another who was in its direct path states that the whirl cut like an auger, only on its outer edge, while in its center no harm was done.

The question as to the origin of tornadoes, whether electrical or not, is unsettled. Much can be said on both sides and the matter can only be decided after much closer study and more comprehensive observation than have so far been given to the phenomena attendant upon such storms. We found no results and have heard of no facts connected with this particular occurrence which could not, in our judgment, be fully accounted for without referring them to other causes than those ordinarily operating in the production of air currents. Still it is possible if we had witnessed this storm as others did, we might have seen cause to form different opinions.

BOOK NOTICES.

THE ASSAYER'S MANUAL: By Bruno Kerl. Octavo, pp. 313; Illustrated. Henry Carey Baird & Co., Philadelphia, 1883. $3.00.

In 1866 Professor Kerl published at Leipsig a large and detailed work upon assaying, of which the present is an abridgement, or, as set forth in the title page, it is an "Abridged treatise on the docimastic examination of ores, furnace, and other artificial products, by Bruno Kerl, Professor in the Royal School of Mines; Member of the Royal Technical Commission for the Industries, and of the Imperial Patent Office. Translated from the German by William T. Brannt, Graduate of the Royal Agricultural College of Eldena, Prussia; Edited by William H. Wahl, Ph.D., Secretary of the Franklin Institute, Philadelphia; Illustrated by sixty-five illustrations."

This work will be found a valuable addition to the literature of chemistry and metallurgy, and to the American student the introduction of the English equivalents of the French metric weights and measures, by Professor Wahl, will be a decidedly useful and convenient matter. The scope of the book can hardly be given in the brief notice we are confined to, but we will designate some of its main points. The author begins with explaining the object of assaying, and the

wet and dry methods; also the manner of precipitating metals by electrolysis, volumetric assays, colorimetric assays and preliminary assays by the blow-pipe. Then mechanical manipulations, such as sampling ores, alloys and non-alloys, washing, weighing, and measuring, fluxes: chemical operations, such as ignition, carbonizing, fusion, precipitation, filtration, volumetric analysis, etc.; assay furnaces, muffles, charcoal and coke and gas furnaces, sublimation and distillation furnaces; assay vessels, balances and weights, tools and implements, and assay reagents. All of these are treated comprehensively and in detail under the first general division of the work and occupy eighty-four pages, copiously illustrated.

The special division includes specific and detailed instructions for assaying the ores and alloys of lead, copper, silver, gold, platinum, nickel, cobalt, zinc, cadmium, tin bismuith, mercury, antimony, arsenic, uranium, chromium, manganese, sulphur, and fuels, comprising 189 pages. An appendix, giving tabular synopses of atomic weights, fusing points of metals, etc., with the methods of assaying employed in the Oker (Lower Hartz) assay laboratory and Schaffner's assay of zinc, and a complete index close the volume. The reputation of the author guarantees excellence of a high degree, while the translator and editor seem to have done their work equally well.

WORK AND WAGES: By Sir Thomas Brassey, K. C. B., M. P. 12mo., pp. 296. G. P. Putnam's Sons, New York, 1883. For sale by M. H. Dickinson.

This work was written at the suggestion of Mr. Arthur Helps, who was preparing a life of the author's father, and is probably as fair and comprehensive a statement and discussion of the questions at issue between employers and employees as has ever been published. The elder Brassey was one of the largest manufacturers and contractors of England in his lifetime and consequently had the greatest opportunities for studying this subject. These opportunities the son shared, and has in addition given much time to the study of the labor-question in all its departments.

The branches of the general subject treated are strikes, trades-unions, demand and supply, industrial capabilities of different nations compared, rise of wages abroad, comparison of the commercial progress of nations, fluctuation of wages, influence of American wages upon the English labor-market, etc. If Mr. Brassey's views upon trades-unions, which he shows conclusively to have been detrimental to the laboring class, could be thoroughly disseminated among both employers and laborers, the effect would certainly be beneficial and serviceable to both classes, as well as to the community in general

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PRACTICAL CARPENTRY: Fred T. Hodgson. 12mo., pp. 144; Illustrated. Industrial Publication Company, New York, 1883. $1.00.

This work is offered to builders and mechanics as a guide to the correct working and laying out of all kinds of carpenter's and joiner's work, with the

solutions of the various problems in hip-roofs, gothic-work, centering, splayed work, joints and jointing, hinging, dovetailing, mitering, timber-splicing, circular work, etc. It seems to be thoroughly practical and reliable, and is written in a clear and concise manner, adapted to either master workman or apprentice. The first thirty-two pages are devoted to carpenter's geometry, with numerous illustrations, while the whole volume contains over three hundred explanatory engravings and cuts.

THE MAINTENANCE OF HEALTH: By J. Milner Fothergill, M. D., M. R. C. P. 12mo, pp. 366. G. P. Putnam's Sons, New York, 1883. For sale by M. H. Dickinson.

This is a book which teaches a vast deal that should be known in every family concerning the means of preserving health and vigor of body. It is not a medical work, but rather a hygienic work; one however, that may be consulted without hesitation by medical students as well as by fathers and mothers, and nurses.

It commences with the discrimination between ideal health and practical health, explaining what the latter actually consists of, including bodily and mental conditions in the category. Then takes up the training of youth, the period of growth, the maintenance of bodily integrity in maturity, the changes induced by advancing age and the corresponding changes rendered necessary in habits, diet and clothing.

The succeeding chapters are devoted to food and clothing, to stimulants and tobacco, the effects of inheritance, the election of pursuit in life, overwork and physiological bankruptcy, mental strain, over-work and tension, hygiene, what to do in emergencies, advice as climates suited to consumptive, gouty and rheumatic patients, etc.

No similar work that we have seen covers so much ground or covers it so well.

CONTRIBUTIONS TO NORTH AMERICAN ETHNOLOGY: Volume V; Illustrated; 4to. pp. 237. Department of the Interior, Washington, 1882.

This is one of the supplemental volumes of the United States Geographical and Geological Survey, in charge of Major J. W. Powell. It is most handsomely printed and fittingly illustrated. The first article is entitled Observations on Cup-Shaped and other Lapidarian Sculpture in the Old World and in America, illustrated with sixty-one engravings, by Charles Rau of the Smithsonian Institution.

The second is upon Prehistoric Trephining and Cranial Amulets; illustrated with eleven plates and figures, by Robert Fletcher, M. R. C. S., Eng., Acting Asst. Surgeon U. S. Army.

The third is one which we have noticed before, A Study of the Manuscript

Troano; illustrated by nine plates and one hundred and one figures, by Cyrus Thomas, Ph.D., with an introduction by D. G. Brinton, M. D.

We shall take occasion to refer to this volume again hereafter, as the subjects discussed and the able writers of the articles deserve more than a mere passing notice, such as we are confined to at present.

OTHER PUBLICATIONS RECEIVED.

Bulletin of the Philosophical Society of Washington. Vols. IV and V. Notes on Copper Implements from Mexico, by F. W. Putnam. Report of the Fish Commission of the State of Missouri for the years 1881 and 1882. How You may aid the Civil Service Reform, by Alexander Fullerton. *The Biographer*, May, 1883; Illustrated; $2.50 per annum. Proceedings of 4th Missouri State Pharmaceutical Association at Kansas City, October 25, 1882. Proceedings of the American Forestry Congress, Cinncinati, April, 1882, and Montreal, August, 1882. Technical instruction in France; Circular No. 6, Bureau of Education. Johns Hopkins University Circulars, Vol. II, No. 22, price 10c. Kansas: Its Resources and Capabilities; Its Position, Dimensions and Topography, prepared by Wm. Sims, Secretary of the State Board of Agriculture, Topeka. *The Acadian Scientist*. Vol. I, No. 4, Wolfville, N. S., A. J. Pineo, Editor, 35c per annum. Answers to inquiries about the U. S. Bureau of Education, Chas. Warren, M. D. The 14th Annual Report of the American Museum of Natural History, May, 1883. Bulletin of the American Museum of Natural History: The Atlantic Right Whales, Joseph Bassett Holder. The *Eclectic Monthly and Educational Journal*, Vol. III, No. 5, Little Rock, Ark., J. Kellogg, Manager, $1.50 per annum.

SCIENTIFIC MISCELLANY.

THE DRAMATIC PROFESSION.

E. R. KNOWLES.

"I think I love and revere all arts equally, only putting my own just above the others, because in it I recognize the union and culmination of all. To me it seems as if when God conceived the world, that was poetry; He formed it, and that was sculpture; He colored it, and that was painting; and then crowning work of all, He peopled it with living beings, and that was the grand, divine, eternal Drama."—*Charlotte Cushman.*

Let philosophers hold what different theories they will, one system of philosophy in particular must have a great attraction for any actor devoted to his profession; namely, that phase of idealism which maintains that all material objects

that we perceive are the ideas of God sustained and presented in accordance with fixed and permanent laws by the eternal spirit for the contemplation of created spirits, imaginary ideas coming and going according as we will. All men are actors in that "grand, divine, eternal drama," simultaneously created and performed.

> "*Spiritus intus alit, totamque infusa perartus*
> *Mens agitat molem.*"

How God-like then, is the genius of the actor who by force of potent will, and by the fortunate possession of a sensitive and ardent soul, can, not merely assume the part of some character in history, or some ideal fictitious person; but, for the time, become another being, even to his own belief almost, and present a portrayal of the living character.

But are we not contemplating an ideal only realized or approached in the case of a minority of those who style themselves members of the dramatic profession? How many actors are there, in the present state of affairs, who are utterly oblivious of the honor and interests of their profession; how few who realize the truth (expressed above in the words of Charlotte Cushman) that

> —"by the mighty actor brought,
> Illusion's perfect triumphs come,—
> Verse ceases to be airy thought,
> And sculpture to be dumb,"

and appreciate the glory of their calling.

Granting all this to be true, we come at once to the conclusion that a complete change is needed for the interests of the profession and every worthy member of it. It is often stated that it is discreditable to our managers that so many excellent and experienced actors should be without means of support, while the veriest "sticks" are provided for because of their cheapness or notoriety, and also that the profession is misunderstood because of popular prejudices, and will, when those prejudices are overcome, be esteemed in its rightful place. These evils can only be overcome, not by idly lamenting them, but by taking active measures to remedy them. The dramatic profession should be protected in its high standing and integrity as the other professions are. Every actor who claims to be a member of this profession should be recognized therein, in the grade he aspires to hold, by some recognized standard authority made up of the brightest and most talented ornaments of our stage; such recognition to be obtained only by passing rigid examinations in such requirements as are necessary for the grade desired, and by satisfactory evidence of good character.

Were this the case, we should no longer witness such displays of ignorance and awkwardness as we now frequently meet with, on the part of even well paid actors, hardly fitted to occupy a position as a grocer's errand-boy, much less as one of a profession necessarily requiring intelligence and *savoir vivre*, and when the profession is slurred in consequence of dishonorable dealing or misconduct on the part of any so-called actors it could say with self-respect: "They are not

of us." It is to be hoped, neither is it improbable, that the youth of the coming generation, instead of being impressed by teachers and associates and the press with the idea that the dramatic profession is an unworthy one, will find it a profession second to none, and will consider success therein an aim worthy of the noblest and most gifted.

EDITORIAL NOTES.

THE Eighth Anniversary Meeting of the Kansas City Academy of Sciences was held at the First Baptist Church in this city on the 29th day of May. The exercises consisted of the Reports of the various officers, an address by the retiring President Hon. R. T. VanHorn, and the election of the new officers, as follows:

President, Hon. R. T. Van Horn; Vice-President, W. H. Miller; Recording Secretary, Dr. R. W. Brown; Corresponding Secretary, Theo. S. Case; Treasurer, Dr. S. D. Bowker; Librarian and Curator, Sidney J. Hare; Member of the Executive Committee, Dr. John Fee.

Professor John D. Parker, was unanimously elected an Honorary Member of the Academy as a token of its remembrance of his faithful services during its early history.

The address of the President, entitled "The Progress of Science during the Past Year," was a full and able *resumé* of recent discoveries in science and of progress in scientific thought. It was very warmly received and will be published in full in the next issue of the REVIEW.

Our citizens cannot do better than to foster the Academy of Science in all practicable ways. They will be proud of it some day.

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DR. EDWIN R. HEATH, whose explorations in South America have given him a world-wide reputation among geographers, and whose articles in the REVIEW have been copied widely, has recently had conferred upon him by the Royal Geographical Society of England, the position of one of its three Honorary Corresponding Members elected in 1883. In the letter of announcement Hon. H. W. Bates, the Assistant Secretary, who is also a great traveler and author, compliments the Doctor upon the superior correctness of his maps over any that have been published hitherto.

THE Semi-Annual Meeting of the Social Science Club, for Kansas and western Missouri, was held at Wyandotte, Kansas, on the 17th and 18th of May last. The proceedings were marked by dignity and ability, and are highly creditable to the literary and scientific tastes and attainments of our western ladies. The Society was organized at Leavenworth, Kansas, in 1881, with the object to promote intellectual growth, raise the standard of woman and open new fields of labor to her. It is composed entirely of ladies, and marks a new era in women's aspirations which is prophetic of a higher plane of womanly dignity and attainments.

WILLIAM SIMS, Secretary of the State Board of Agriculture of the State of Kansas, has prepared an admirably complete and comprehensive statement in a pamphlet of sixty pages, of the resources, capabilities, position, dimensions and topography of Kansas, with statistics concerning its lands, agriculture, horticulture, live stock, schools, manufactures, mines, minerals, etc., which will be sought for all over the country. It is also being printed for gratuitous distribution, in the German, Swedish and Danish languages.

WE observe that most of the Kansas editors, in their descriptions of the excursion to Mexico draw freely (as we do also) upon the pointers, folders and circulars furnished by the Passenger Department of the A., T. & S. F. R. R. This is a compliment to Mr. J. S. McLain, formerly of this city, who is the reliable author and compiler of most of them and whose accuracy is unquestioned.

F. W. CRAGIN, Sc. B., of Washburn College, Topeka, is one of the first western writers who has described the structure and habits of the *Copepods* or oar-footed crustacea of North America. This article is published in full in the "Transactions of the Kansas Academy of Science for 1882.

THE New York Life Insurance Company sends to its friends a handsome lithograph published by Root & Tinker, entitled "Origin of the Stars and Stripes," and accompanies it with an explanatory pamphlet containing numerous facts relating to the genealogy of Washington, and the origin of our flag that will be new to most readers.

AMONG the recent novels of the Trans-Atlantic Series published by G. P. Putnam's Sons, none are more interesting or ably written than King Capital by Wm. Sime, or My Trivial Life, in two volumes, by A Plain Woman. All the numbers of the series so far as we have seen them are vigorous in style and of a healthy moral tone. 50c each.

PROF. D. A. BASSETT, of Wabash College, Indiana, says, "I have not forgotten my promise to you to write an item on Crinoids for your REVIEW. I intend to do it yet. I like the REVIEW very much and inclose postal order for $2.50 for the year."

PROF. J. E. SIEBEL, Analytical and Consulting Chemist and Editor of the *American Chemical Review*, Chicago, writes "Please send No. 1, Vol. VI of the REVIEW, so that I may have the whole volume complete for convenient reference."

PROF. G. C. BROADHEAD, late State Geologist of Missouri, writes as follows: "The REVIEW may not be financially successful but it is certainly a valuable collection of information interesting to the people of the Mississippi Valley and the entire Rocky Mountain slope. My means are meagre but I must have it."

ITEMS FROM PERIODICALS.

Subscribers to the REVIEW *can be furnished through this office with all the best magazines of the Country and Europe, at a discount of from 15 to 20 per cent off the retail price.*

Harper's Weekly for May 26th is largely devoted to a description, with admirable illustrations, of the opening of the wonderful New York and Brooklyn Bridge on May 24th.

NUMBER 7 of the Johns Hopkins University Studies in Historical and Political Science is entitled "Old Maryland Manors," by John Johnson, A. B., and is the most interesting writer we have yet received. These Studies are edited by Herbert B. Adams, and published monthly in pamphlet shape; $3.00 per annum.

The Patent-Office News is the name of a weekly, sixteen-page, octavo, recently started by Messrs. Howe and Nicholas, at Washington, D. C. It is devoted to patent matters of all kinds. If the work of editing continues to be as thoroughly done as it is in the first few numbers, the *News* will be of great value to inventors and the public generally.

THE *Scientific American*, for May 26th, contains an illustrated article descriptive of a method proposed by John C. Goodridge, C. E., for erecting the pedestal and statue of "Liberty Enlightening the World," without the vast expense of scaffolding. It is, in brief, to construct the statue first and place it upon the site of the pedestal, then gradually push it upward as the masonry of the pedestal is completed beneath it. The plan seems admirably effective.

THE *American Trade Journal*, of St. Louis, edited by Major F. F. Hilder, has spent a large sum of money in preparing a bird's-eye view of the Mississippi River, from the Missouri to the Gulf of Mexico, which is beautifully executed and surprisingly correct. It gives all the windings of the river, the towns and villages, bayous, lakes, tributaries, etc., with the greatest accuracy, and cannot fail to be of great value to all persons interested either in the geography or the commerce of the great valley.

THE publishers of *The Art Interchange* have decided to issue an eight-page extra on May 22d, thirteen columns of which will be given up to Notes, Queries and Answers, treating, among other subjects, on Artistic Furnishishings, Embroidering, Repousse Work, Wood Carving, Decorative Oil Painting, Stenciling, Painting on China, and Leather Work. This department is of great practical benefit to all interested in Art. The Extra will be furnished free to regular subscribers of *The Art Interchange*, and can be bought by others through news companies for ten cents, or by addressing *The Art Interchange*, 140 Nassau St., New York.

THE June number of the *North American Review* opens with an article by Joseph Nimmo, Jr., Chief of the Treasury Bureau of Statistics, on American Manufacturing Interests, in which is given a singularly full and instructive historical sketch of the rise and progress of manufactures in the United States, together with a very effective presentation of their present condition, and of the agency of tariff legislation in promoting diversified industries and encouraging the inventive genius of the people. Should this author's advocacy of protective legislation prove distasteful, the reader finds the needed corrective in an article by the Hon. Wm. M. Springer, on Incidental Taxation, which is an argument for Free-Trade. D. C. Gilman, President of Johns Hopkins University, writes of the Present Aspects of College Training, as affected by the increase of wealth and luxury, the development of natural science, and the influence of a larger religious liberty. Edward Self presents some weighty considerations on the Abuse of Citizenship, as exhibited in the machinations of the dynamitists against a friendly power, in disregard of the obligations of American neutrality. Prof. Isaac L. Rice criticises some of Herbert Spencer's Facts and Inferences, in social and political science, and Christine Nilsson contributes A Few Words about Public Singing. Finally, there is a symposium on The Moral Influence of the Drama, the participants being, on the one side, the Rev. Dr. J. M. Buckley, well known as an opponent of the stage, and on the other, John Gilbert, the actor; A. M. Palmer, theatrical manager; and William Winter, dramatic critic.

NUMBER 44 of the *Humboldt Library* is devoted to a republication of Part I of The Dawn of History, an introduction to prehistoric study, edited by C. F. Keary, M. A., of the British Museum; octavo, pp. 46, 15c.

HARPER'S MAGAZINE for June is an unusually varied number, profusely and beautifully illustrated. The frontispiece (illustrating "Faustus"—a poem by S. S. Conant), is from a drawing by E. A. Abbey. Lambeth Palace: "Ye Archbishop's Inne,"—Zadel Barnes Gustapson, (with ten illustrations). The Folding. A Poem—Annie Fields. The Hundred Years' War.—T. W. Higginson, (with seven illustrations). A Castle in Spain. A Novel. Part II, (with four illustrations by Abbey). Indian Arts in Metal and Wood.—J. L. Kipling, (with fourteen illustrations. On the Edge of the Marsh. A Poem.—Miss A. A. Bassett. The Home of Hiawatha.—Ernest Ingersoll, (with twelve illustrations). Sunlight Mysteries—William C. Wyckoff, (with nine illustrations). Rus. A Sketch.—Charles Reade. Unuttered. A Poem.—John B. Tabb. The Romanoffs. Part I.—H. Sutherland Edwards, (with thirteen portraits. Death in the sky. A Poem. —George Edgar Montgomery. Faustus. A Poem.—S. S. Conant. Carlsbad Waters.—Titus Munson Coan, M. D. The Mount of Sorrow.—Harriet Prescott Spofford. An Æsthetic Idea. A Story.—A Working-Girl.

J. C. EGELHOFF,

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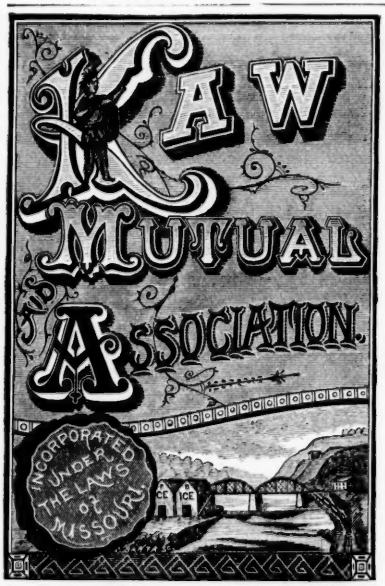

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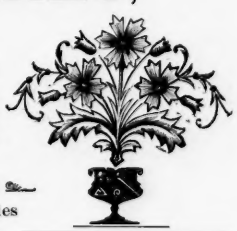

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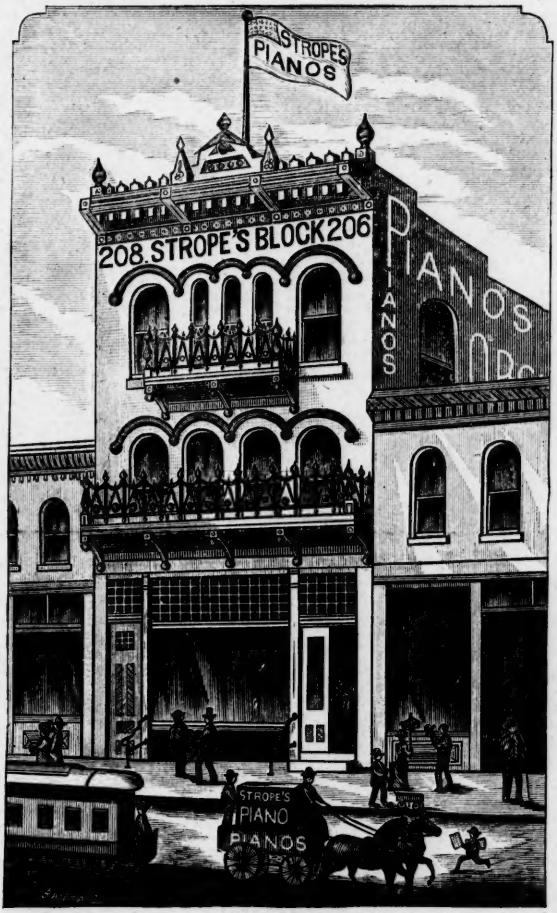

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